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SCIENCE AND TECHNOLOGY POLICY

No. 3

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ERGONOMICS AND DESIGN STRESSED IN NEW S&T TRENDS

Moscow PRAVDA in Russian 2 Feb 82 p 3

[Article by V. Zinchenko, professor and department head at Moscow State University, and V. Munipov, deputy director of the All-Union Scientific Research Institute of Technical Esthetics and a candidate of psychological sciences: "Technology in the Presence of Man"]

> [Text] Under present conditions, it was noted at the 26th CPSU Congress, the intensive route for developing a socialist economy acquires decisive significance. In light of this situation, it is worth looking more carefully, perhaps, at the relatively new areas of scientific-technical progress, ergonomics and human engineering.

Ergonomics and human engineering, synthesizing the media of art and engineering design, are making a definite contribution to the search for effective and complex methods for utilizing the intensive factors of economic development.

The appearance of ergonomics was caused naturally by the development of modern production. You see, today, production is equipped with complicated technical systems and increasing demands are placed on man, which require him sometimes to work near the limits of psychophysiological capacities. In this connection, an error in controlling large systems is fraught with serious consequences. Therefore, when designing and updating technology, it is necessary beforehand and with maximum achievable completeness to take into consideration the capacities and peculiarities of the people who will utilize it. Indicators of physical equipment in production must also be skillfully adapted to man's capabilities. Only under this condition, can high effectiveness in his work be counted on.

Thus, the subject of ergonomic research is neither technology nor man alone, but the agreement between the physical and psychophysiological capabilities and characteristics of the worker, on the one hand, and the properties of the technical equipment (systems) and the conditions for its functioning, on the other. The methods and criteria being developed by ergonomics are applicable to any sphere of production and everyday life. Briefly it can be formulated thus: maximum attention to man through the design of technology and industrial items for purposes of culture and everyday life.

Under the 10th Five-Year Plan, our country achieved definite successes in the development of ergonomics and its use in various spheres of the economy. A number of ministries and agencies (the Ministry of Civil Aviation, the Ministry of the Aviation Industry, the Ministry of Machine Building for Light and Food Industry and Household Appliances, the Ministry of Tractor and Agricultural Machine Building, the Ministry of Instrument Making, Automation Equipment, and Control Systems, the Ministry of the Electrical Equipment Industry, the Ministry of the Automotive Industry, the Ministry of Heavy and Transport Machine Building, and the Ministry of Power Machine Building) created or organized special services and fulfilled an increasing volume of projects in the field of ergonomics. They rest upon 30 state and a large number of ministerial standards and interministerial requirements for efficiency in design. Methodological recommendations according to ergonomic assessment of product quality and technological processes, and also manufactured items for purposes of culture and everyday life, have been prepared and are undergoing industrial proving.

What this provides to the economy is evident in the example of the long-term complex special-purpose human-engineering and ergonomics program of cooperation between the All-Union Scientific Research Institute of Technical Esthetics (VNIITE) and the "Soyuzelektropribor" all-union association of the USSR Ministry of Instrument Making, Automation Equipment, and Control Systems, which includes 32 factories and tens of design bureaus and scientific-research institutes. The association puts out over 1200 denominations of electrical measuring instruments. Within the framework of the program, an optimum assortment of products has been formulated with consideration for the variety of users and the sphere of utilization. The products being manufactured by the association are looked upon as a unified system. This has permitted, in particular, the reduction of the wide variation in constructive subassemblies and components of manufactured items to a limited, but substantiated, number of elements responding to the requirements of ergonomics and technical esthetics. In this connection, the preconditions have been created for complex utilization of instruments. Also subject to human engineering and ergonomic study are packaging, advertising, documentation, and publications of the association.

In the course of fulfilling the program on the basis of ergonomic research, plans appeared for typical work places and work clothes for various shops. Rest zones applicable to specific work conditions were created. In landscape planning, types of trees and bushes were used to maximize reduction of the harm done by an enterprise to the environment.

Even this cursory and fragmentary story of the program permits one to imagine its scope. This is also evidenced by the economic effect of 12.6 million rubles. However, this figure far from fully characterizes the economic aid and, especially the social effects, that were achieved in the course of fulfilling the program. What is more, the calculation according to existing methodologies often creates a "mathematically based" impression that ergonomics and human engineering are unprofitable, whereas life shows the reverse. It is necessary for the Institute of Economics of the USSR Academy of Sciences and other economics organizations to force the development of methodology for evaluating the social-economic effectiveness of introducing the achievements of scientific-technical progress.

Now, VNIITE, its ten branches, and other organizations are fulfilling a number of complex special-purpose human engineering and ergonomic programs. The program on agricultural technology should be especially noted. A high level of artistic design, comfort, and convenience in technology can help attract specialists to agriculture, including young people and women, raise labor productivity, and increase competitiveness for products of this type in external markets.

Further intensification of the economy especially requires an increase in the effectiveness in the automation of production control. Now, some specialists experience disillusionment from the results of work on automated control systems. Often, this is explained by underevaluation of the "human factor" at the stage when the automated control system is being designed. As a result, there arises a disparity between the planned effectiveness and what is actually achieved. That is why, recently, designers of automated control systems have been trying more to take social and ergonomic aspects into consideration in automating production. Evidence of this, in particular, is the experience with a complex ergonomic and human engineering program by scientists at the Belorussian branch of VNIITE jointly with specialists of the Belorussian Main Administration for Power, and also equipment for a control console at the Ural United Power System, designed by its specialists jointly with VNIITE and the Institute of Psychology of the USSR Academy of Sciences.

Domestic and foreign experience shows that taking into account the requirements of ergonomics in developing automated systems and other technical equipment permits increasing their effectiveness by 5 to 10 percent and reducing the time required for vocational training of specialists by a fourth. In this connection, the methods and means of ergonomics allow making their work more meaningful, interesting, and creative.

The growing needs for ergonomics give special urgency to the implementation of organizational and legal measures related to its further development. Conceptually new possibilities are being opened up here by the ergonomic data bank that has been started by our scientists jointly with colleagues of CEMA-member countries. At the same time, it is necessary for scientific-research and design organizations in the field of ergonomics to give wider range to the creation of experimental complexes with the utilization of computers and, together with VNIITE, to develop a typical set of equipment and apparatus for research under production conditions. At the same time, ministries and agencies should be concerned about a more organic inclusion of ergonomics in the system for designing, planning, and controlling the creation of new technology.

These and other vital problems in the development of a young scientific discipline will be solved more successfully if the USSR State Committee for Labor and Social Problems determines the legal status of specialists in the field of ergonomics in industry. It is true that our higher schools still do not graduate these specialists. Meanwhile, the necessary preconditions for their training have been created: there are programs of study, textbooks have been published, and certain experience has been accumulated in the specialization in this scientific discipline by students of psychology departments of universities. It would be worthwhile for the USSR Ministry of Higher and Secondary Specialized Education to organize training for such specialists, experimentally at first.

What is more, we consider that ergonomics should be an integral part of engineering training, for which appropriate departments are necessary in the leading technical VUZ's of the country. And the USSR Higher Certification Commission, together with the USSR State Committee for Science and Technology, needs to decide the question of including ergonomics in the official list of scientific specialties.

It is thus a matter of disseminating, through the medium of production organizers and technical specialists, ergonomic culture, as an integral part of the overall production and labor culture.

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NORMATIVE METHOD OF PLANNING AND FINANCING S&T

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 1, Jan 82 pp 47-57

[Article by G. Plekhov, candidate of economic sciences: "On Normatives for Planning and Financing the Development of Science and Technology"]

[Text] During the 1970's, the production apparatus of the country was actively reorganized on a new technical basis. Networks of scientific-research, planning-design, and technological organizations and experimental shops were formed in all branches of industry. Tasks were set for shortening the times for creating and assimilating advanced technology, progressive construction materials, and technological processes and for improving the quality of manufactured products. Within the total amount of capital investment put into the development of production, there was an increase in the proportion directed toward re-tooling and reconstruction. Scientific-technical progress became a basic factor in economic growth.

The revolution in science and technology requires the creation of conditions that bring about more rapid implementation of scientific ideas in production. The period referred to above was one of broad experimental trials of new forms and methods for planning, financing, and economic incentives for scientific-research, planning-design, and technological projects and measures for the introduction and assimilation of technical innovations. There was improvement in the management system for scientific-technical progress, which found expression in the decree of the CPSU Central Committee and USSR Council of Ministers, "On Improving the Planning and Strengthening the Influence of the Economic Mechanism on Increasing the Effectiveness of Production and Work Quality."

Measures adopted at that time, although local, for accelerating scientific-technical progress on the basis of individual elements of the existing system for planning and for providing economic incentives provided definite results. The average length of time for the creation of new technology from the development of technical documentation to the fabrication of an experimental model and its adoption in production, for machine-building ministries as a whole during the 9th and 10th Five-Year Plans, was 2.7 years. The proportion of models for new types of machines, equipment, and devices developed over one or two years rose from 52 percent in 1970 to 56 percent in 1979, but the proportion of instruments and automation hardware somewhat declined.

The success rates of work by scientific-research and design organizations improved. The share of models of new technology accepted for production from among the number of those created, on a yearly average, increased by the end of the 1970's by roughly 10 percent.

At the same time, no substantial progress was made in solving the problem of accelerating technical innovation. The average lengths of time for creating models of progressive technology stayed at the level that evolved during the 9th Five-Year Plan. Therefore, at the 26th CPSU Congress, it was noted that accelerating the development of new technology and new technological processes would be one of the chief questions for the 1980's.

There was also a lack of success in the organization of production assimilation of new technology. The proportion of models for new types of machines, equipment, and devices for which output was planned for the third and following years after their creation grew from 14 percent in 1970 to 22 percent in 1979, and instruments and automation hardware, respectively, from 18 to 21 percent. The share of models for which manufacture was begun within a year of their creation, of the total number of models adopted for introduction, was 25 percent in 1979 as against 26 percent on the average during the years of the 10th Five-Year Plan and 29 percent during the years of the 9th Five-Year Plan.

The preparation of production for the output of new manufactured items remains the weakest link in the "science-production" cycle.

As a consequence of this, in industry in recent times, the proportion of products assimilated for the first time in the USSR has been decreasing. The rates of production saturation by new, highly productive labor hardware and tools and progressive construction materials have been held back. In the final analysis, the rates of growth in civil labor productivity have slowed down.

The introduction of scientific discoveries and inventions was determined by the 26th CPSU Congress to be the decisive, most urgent sector in accelerating scientific-technical progress during the 1980's. In the solution of this problem during the 11th Five-Year Plan, first priority is being allotted to the implementation of a complex of measures developed by the CPSU Central Committee and the USSR Council of Ministers for improving the economic mechanism.

Among the many questions relating to improvement in the economic mechanism, special attention has been allotted to improvement in the balancing of planned tasks according to all indicators. Various ways for achieving this aim have been planned. One of these is wider utilization of technical-economic norms and normatives for consumption of resources. With respect to planning the development of science and technology in the 1981 plan, amounts of expenditures for scientific-research, experimental-design and technological projects for a majority of industrial ministries have been determined through the use of a normative established in percentages of the volume of goods output and, in individual economic sectors, of the normative net product. The wage fund for workers in scientific and design organizations has been calculated using the normative adopted for the economic sector in percentages of the amount of expenditures for scientific-research, experimental-design, and technological work.

The economic meaning of the normative method for planning the amount of expenditures for scientific-research and experimental design [SRED] work is that, under the conditions of present production, the manufacture of products with improved technical-economic characteristics is not possible without definite scientific preparation for their reproduction. Therefore, to maintain the rates that have evolved for raising the technical level of manufactured products and production during the forthcoming planning period in SRED work, it is necessary to invest an amount of means suitable for the objective conditions. It can be stated that the normative for determining the planned volume of expenditures for SRED work reflects the amount of science involved per unit of product cost in an economic sector under the conditions that have evolved for its production.

This approach to planning expenditures for the conduct of scientific-research, planning-design, and technological work has required corresponding changes in procedures for financing measures for scientific-technical progress within an economic sector. Instead of a number of sources for financing -- budget allocations, deductions from goods output for scientific-research work and assimilation of new technology, receipt of money for fulfilling SRED work according to contracts, and others -- a unified fund for the development of science and technology (YeFRNT) has been established for ministries. It is formed basically from the planned profit of enterprises according to a normative established for a ministry in percentages of goods output and, in individual economic sectors, of normative net product.

The normative for determining the planned amount of expenditures for scientific-research, experimental-design, and technological work and the normative for forming the unified fund for the development of science and technology are closely related with one another. The fund serves as a source for financing the whole "science-production" cycle: scientific-research, experimental-design, and technological work, development and assimilation of new types of products and technological processes, and also additional expenditures for the introduction of efficiency and improvement of product quality.

The size of the unified fund is regulated by the amount of financial resources directed toward production assimilation of the results of scientific-research and design-technological work and toward compensation for increased expenditures during the first years of production of new products. Part of the fund, with the exception of money for financing SRED work, appears as a planned amount of expenditures for the introduction and assimilation into production of new technology and improvement in product quality. In this connection, important significance is acquired by the establishment of an economically substantiated unified fund and the distribution of the fund for financing SRED work and measures for the introduction and assimilation into production of progressive techniques and technology.

In industrial sectors that have been transferred to the new system for planning, financing, and economic incentives for scientific-technical progress, normatives have been determined during the year of a ministry's transfer to the system by an accounting method. This method took into account the level of expenditures financed from the fund for assimilating new technology and the fund for financing SRED work, allotments from the state budget and receipts from contracts, and also actual ratios during the previous five-year plan between growth rates in expenditures for SRED work and the volume of goods output. Methodological instructions approved by the State Committee for Science and Technology, USSR Gosplan, the USSR Ministry of Finance, and the USSR State Committee on Prices on procedures for forming and utilizing a unified fund for the development of science and technology recommend, in determining normatives for deductions for the planning period, proceeding on the basis of the size of the organization's own expenditures for fulfilling scientific-research, experimental-design, and technological work and measures related to the development and assimilation of new technology during the year previous to the one being planned for.

In other words, the capacity of scientific, design, and technological organizations is taken as a basis for calculating normatives. Poorly taken into consideration are possible changes in conditions for product reproduction -- broadening of the range of products, acceleration or retardation of renewal rates, growth in the proportion of products of the highest quality category in the total output, and the stiffening of demands for technical level of products on the part of related economic sectors. Any deviation from the factors listed or others can affect the actual demand by an economic sector for amounts of scientific preparation for the reproduction of products and, consequently, can affect the normatives for determining the amount of expenditure for SRED work and for formation of the unified fund. And, on the other hand, the lack of money for scientific preparation for product production can retard the speed of development of advanced trends in the sector.

This procedure for forming normatives does not provide for their progress or for coordination with the tasks facing the sector during the period being planned for or the anticipated results of scientific-technical progress, and can contribute to the reinforcement of the incongruities that have come about in the levels of scientific preparation for the reproduction of products of related sectors. This, in the final analysis, will entail retardation in the rates of technical progress in the economy. The initial normatives, as is known, are not in themselves a basis for establishing in the plan rates of growth, advantageous from economic aspects, in expenditures for SRED work in a sector and proportions in the distribution of resources for scientific preparation for product reproduction among related sectors of industry. They can have stimulating or retarding effects on the economic results of technical development in a sector (labor productivity, technical level, quality of products being manufactured, etc.) and, consequently, on the formation of a supply and equipment base for production. There arises the task of more fully reflecting in a normative changes in the conditions of scientific preparation for reproduction of products of an economic sector with consideration for the totality of factors, including requirements on the technical level of products on the part of the user ministries.

As it seems to us, to establish a scientifically substantiated normative for expenditures for scientific-research, planning-design, and technological work and a normative for the amount of a unified fund, it is necessary to find a closer relationship between the amount of expenditures for SRED work and the volume indicators that express the final result of the production that these expenditures affect. It is important to reveal the character of the effect of investments in SRED work on changes in the qualitative and quantitative parameters of the products being reproduced, and to determine the broadside manifestation, in natural-material form, of the results of expenditures for scientific preparation of product reproduction in a sector. On this basis, it is advisable to formulate requirements for the development of scientific-research, planning-design, and experimental bases for the sector and to establish normatives for determining the volume of expenditures for SRED work and for forming a unified fund.

The decree of the CPSU Central Committee and USSR Council of Ministers on improving the economic mechanism recommended two indicators as the basis for calculating a normative for expenditures for scientific-research, experimental-design, and technological work and normatives for forming a unified fund: net product (normative) and goods output.

The normative calculated as the ratio between the volume of expenditures for SRED work and the volumes of goods output produced by enterprises of the ministry has definite economic meaning. It can be treated as a certain constant which characterizes the process of product reproduction in the system of a given ministry. The numerator and denominator of the ratio have equal economic content. The cost estimate for labor and material expenditures in the sphere of scientific and design work compares with counterpart estimates in the sphere of production.

The economic content of the normative, estimated as the ratio of expenditures for SRED work to the volume of net product (normative), is more conditional. In this case, the cost estimate of labor and material expenditures compares with the same kind of estimate for just labor expenditures in production.

It seems that it would be better substantiated to calculate the normative as a ratio of wages with extra charges in the sphere of SRED work to net product (normative). This normative has a definite economic meaning. To maintain the level of product reproduction that has come about in the sector, for each unit of labor (necessary also with a known conditionality of surplus) in production, there is a need for preliminary investment of n units of labor in the sphere of SRED work. Indirectly, such an approach to calculating the normative is proposed by the cited decree of the CPSU Central Committee and the USSR Council of Ministers. It has been established that the wage fund for workers in scientific-research, design, and technological organizations is determined in percentages of the volume of expenditures for SRED work.

As is known, the indicator for net product (normative) was introduced for a more objective estimate of the contribution of an enterprise collective to the final results of production. Its use in planning also has as an object the elimination of the enterprise's interest in manufacturing products with higher content of materials.

The normative for determining expenditures for SRED work and for forming a unified fund shows what part of the additional product during each planned period should (can) be allotted by society to a production sector (ministry) for the scientific preparation for product reproduction in the interests of receiving in the future the maximum economic effect from the consumption of products by this sector. It will be confirmed in the plan only for ministries, although in this there is a certain conditionality, since the sector concentration of product production of a given sector within the framework of a ministry is not taken into consideration.

Insofar as the actual requirement of a sector for amounts of scientific preparation for the reproduction of its products is still determined with sufficient accuracy and may exceed the financial capabilities of the ministry, the utilization of money from the state budget is provided for, along with money from the unified fund, to finance especially important scientific-research projects that require significant expenditures.

As it seems to us, in determining the amounts of expenditures for SRED work and for forming unified funds according to established normatives for a number of ministries, there should be an increase in the amount of goods output produced in the system of a ministry by the size of the volume of such products being temporarily imported. If such deliveries are accomplished over a long period, it is advisable also to take them into consideration in calculating normatives. Thus, the outfitting of the chemical and petrochemical industries with equipment during recent five-year plans has been accomplished almost 50 percent by imports. Among the equipment are items that are not produced by domestic chemical and petrochemical machine building. This sector should have the opportunity to take part in the reproduction of equipment on a new technical basis.

The normative planning of expenditures for SRED work (long-term investments), depending on the results of current activities, assumes that the basic parameters of product reproduction in the sector will be maintained in the future (across the broadside manifestation of effect from these expenditures). In connection with this, special significance is acquired by the estimate of the progression of normatives. These should take into consideration all future changes in the character of product reproduction in the sector.

Statistics provide certain information on the natural-material manifestation of the results of investment in SRED work. These are the lengths of time in creating models of new techniques and technology for the first time in the USSR and their quantity, and also obsolete types taken out of production. According to this information, it is possible to judge the growth or reduction in range of products produced at enterprises of a ministry.

Selective investigation and certification of models at stages of their creation and series manufacture permits judgment of the qualitative aspect of expenditures for SRED work. In addition, a systematic expert evaluation, conducted at the end of the 10th Five-Year Plan, of the technical-economic level of machine-building products being manufactured provides a certain idea of the difference in quality of scientific preparation of product reproduction in machine-building sectors. This information makes it easier to accomplish the task of concentrating efforts of scientific-research and design-technological organizations on the most backward parts of the working machines being produced and at the same time the task of raising the technical level of production and products.

To substantiate the views expressed, let us try to evaluate, relying on statistical data, the practice that has evolved for planning the preparation of product reproduction in machine-tool building and in the related electrical equipment and instrument-making industries.

As already noted, the average length of time for developing models of new technology, progressive materials, and technological processes was 2.7 years during the last 10 years. Roughly the same amount of time was required for assimilating machines, equipment, instruments, and materials into production. Consequently, the broadside manifestation in production of the results of investments in SRED work can be taken as equal roughly to five years. Proceeding from this assumption, let us try to evaluate the 10th Five-Year Plan results from expenditures for the scientific preparation for product reproduction in the machine-tool-building, instrument-making, and electrical-equipment industries accomplished during the years of the 9th Five-Year Plan.

From 1971 to 1975, in the Ministry of the Machine Tool and Tool-Building Industry, expenditures for scientific-research, experimental-design, and technological work increased by 126.3 percent. This growth rate in scientific preparation for product reproduction in machine-tool building provided for the creation, during the 10th Five-Year Plan, of models of technology and technological processes with improved technical-economic characteristics. Fundamental attention was given to the development and assimilation of precision, heavy, and unique machine tools, automatic and semiautomatic machines, and machine tools with numerical program control.

The newly created machines and machine tools differ from those produced from 1971 to 1975 by a higher degree of mechanization and automation of component formation. The systems built into the design of these machines and machine tools permit the combination of the component-forming process with qualitative and quantitative control over their manufacture. In operating a stock of this equipment, there is an expansion of the possibility to apply multiple-machine-tool service and, consequently, conditions are created for reducing the number of personnel working in control operations. The productivity of a set of equipment manufactured in 1980, according to ministry estimates, grew by 27 and 58 percent in comparison with 1975 and 1970, respectively.

The transition to the production of shape-forming machines and their complexes (mechanized and automated production lines) that are more complicated in their structure and fittings, with increased technical-economic parameters, have made possible an increase in labor consumption of scientific-research and planning-design work and expenditures for their conduct. This has been accompanied by a reduction, during the 10th Five-Year Plan, of the number of metal-cutting machine tools and casting equipment created for the first time in the USSR by about 10 percent on a yearly average in comparison with 1971 to 1975.

Noticeable changes have taken place in the structure of the products produced. By the end of the 10th Five-Year Plan, in comparison with 1970, the output of progressive machine-tool-building products increased as follows: machine tools with numerical program control, by a factor of 5; automatic and semiautomatic production lines for machine building and metal processing (sets), by a factor of almost 1.4; forge-press automatic machines, by a factor of 1.8; automatic and semiautomatic production lines for lumber processing (sets), by a factor of 2.85; and automatic and semiautomatic casting machines (pieces), by a factor of 4.6. Production was begun of automatic manipulators with programmed control (industrial robots), which in 1970 did not exist at all.

The rates have accelerated in the removal from production of obsolete designs of metal-processing, forge-press, and casting equipment. This has led to retardation in the accumulation of different types of machines being produced by machine-tool building.

This rate in creating and updating forming equipment permitted an increase by a factor of 5, during the years of the 10th Five-Year Plan, in the share of products of the highest quality category and, in 1981, to carry it on up to 41.5 percent of the total volume of the goods output of the machine-tool and instrument-making industries. Scientific-technical experience has been accumulated, and a theoretical design backlog has been created which permits planning machines and complexes of machines that surpass existing counterparts in productivity by a factor of 3 to 5. However, the further rise in the technical level of a number of types of machine-tool-building products is constrained by the backwardness of complementing items. This, in turn, has significantly reduced the reliability, durability, and competitiveness of new models of domestic machines.

The lack of coordination of processes for the scientific preparation for reproduction of the fundamental links in the machine systems is caused by objective factors. For the sphere of scientific research and development, taken as a whole, there is a characteristic disproportionality. As it seems to us, one of the tasks for planning is the timely revelation of disproportions that arise in the field of scientific preparation for industrial product reproduction and the assignment of priority to the development of backward sectors of scientific research and development. Planned action for improving the material conditions for scientific research and for preferential provision of qualified personnel to individual sectors of SRED work will create the preconditions for expanding the volume and raising the quality of scientific preparation for product reproduction in any industrial sectors and for raising the technical level of new technology being developed as a whole.

The exposure of the disproportions in the scientific preparation of industrial product reproduction has been aided by an evaluation, conducted by the State Committee for Science and Technology, USSR Gossnab, USSR Gosplan, and the USSR State Committee for Standards in 1979-1980, of the technical level of machines, equipment, and other technology for production purposes. Henceforth, such work will be accomplished systematically. It has been established that about 30 percent of the items subjected to evaluation (according to the quantity of type designations) had become obsolete and require modernization or removal from production. Many types of machines, equipment, and instruments being manufactured are inferior to the best domestic and foreign counterparts according to per unit capacity, productivity, specific metal and energy resources consumption, labor consumption of service and repair, and the quality of finishing. Thus, in metal cutting equipment, 26 percent of the inspected basic models of machine tools manufactured in series in 1980 by the Ministry of Machine Tool and Tool Building Industry were subject to modernization or removal from production as obsolete.

An insufficiently high level of complementing items (numerical program control devices, electric devices, bearings, etc.) and a limited application of progressive and high strength materials in designs produced by the Ministry of Instrument Making, Automation Equipment, and Control Systems, the USSR Ministry of the Electrical Equipment Industry, and the USSR Ministry of Ferrous Metallurgy are cited as the basic reasons for a certain lag in the technical level of domestic machine tools behind the best foreign counterparts along with insufficient utilization in designs for machines and equipment of the latest scientific and technical achievements.

The timely evaluation of the lag that has evolved in the technical level of products being manufactured and the measures adopted for strengthening the scientific preparation for their reproduction has coused accelerated creation and expansion in the production of high quality new technology in the electrical equipment industry and in instrument making. Expenditures for scientific-research, experimental-design, and technological work from 1971 to 1975 increased in the Ministry of Instrument Making, Automation Equipment, and Control Systems by more than 154 percent and, in the Ministry of the Electrical Equipment Industry, by 150 percent. There was an increased success rate in the activities of scientific and design organizations. There was an increase in the proportion of developments which, after the fabrication and testing of experimental models, received favorable decisions on possibilities for producing manufactured items.

In the electrical equipment industry, the attention of scientific-research and planning-design organizations has been concentrated on the creation of conceptually new products with a significant increase in their effectiveness and quality and with systematization of product types among the items being manufactured. Here there have been more rational expenditures for SRED work. Among the total number of models of new technology created, the sector had the largest proportion of items, the technical-economic level of which exceeded domestic and foreign achievements. Among the total number of models of new technology being created, there was a systematic increase in the share of those being assimilated into production, and the highest percentage of items of the highest quality category in the total volume of goods output in machine building was maintained.

Improvement in the supply and equipment conditions for conducting SRED work in instrument making under the 9th Five-Year Plan (the average yearly growth rate in expenditures for SRED work was 9.1 percent), despite significant complications in new products, permitted under the 10th Five-Year Plan the maintenance at the achieved level of the number of instruments and automation hardware pieces created for the first time in the USSR. Almost a third surpassed domestic and foreign counterparts in technical-economic level. According to this indicator, instrument making occupied second place after the electrical equipment industry among the machine-building sectors.

Increased attention to the final results of the activities of scientific-research and planning-design organizations made possible a significant (137%) growth in comparison with the 9th Five-Year Plan in the quantity of new-technology models assimilated into production on a yearly average. The range in types of items and scope of work of measuring instruments and automation hardware expanded; the output of the more progressive types of this equipment grew; the precision and reliability was improved; and the functional capabilities of hardware for forming control signals and allotting information have been improved. There has been development in scientific instrument making and in the production of instruments and automation hardware for medicine and agriculture.

All this has permitted rapid growth rates in expanding the share of manufactured items of the highest quality category in the total volume of goods output. In 1981, the proportion of such items in correspondence with the plan of the Ministry of Instrument Making, Automation Equipment, and Control Systems should be 40.5 percent, which is more than in 1975 by a factor of 5. In the share of products of the highest quality category, instrument making occupied third place among the machine-building sectors, after the electrical equipment and machine-tool building industries.

Under the 10th Five-Year Plan, the ratio that had come about between acceleration rates of preparation for product reproduction in these sectors underwent principal changes. Whereas the rates of growth in expenditures for SRED work increased somewhat in machine-tool building, they decreased to about one half the previous rates in the electrical equipment industry and to five-sixths of the previous rates in instrument making.

The maintenance of growth rates in expenditures for SRED work in machine-tool building has been fully substantiated. The party and government have given the sector the task of significantly raising the technical level and competitiveness of metal processing, casting, and wood processing equipment and tools. By 1986, in comparison with the indicators achieved under the 10th Five-Year Plan, the productivity of mettal-cutting machine tools, forge-press machines, and casing and wood working equipment will grow by a factor of from 1.3 to 1.6. In prospect are increases in processing precision on metal-cutting machine tools and operational reliability and durability for metal-cutting, forge-press, casting, and woodworking equipment being manufactured. These goals for 1981 to 1985 have provided for corresponding development of the supply and equipment base for scientific-research, technological, and planning-design organizations, experimental shops, and enterprise laboratories.

The task placed before machine-tool building of raising the technical level of manufactured products cannot be accomplished in isolation from the development of the related electrical equipment industry and instrument making. Already, under past five-year plans, these sectors held back growth in the technical level of individual types of forming and shaping equipment. They did not satisfy orders from machine-tool builders in the quantity and, at times, in the technical level of the items ordered for development to complete pieces of equipment. Thus, from 1971 to 1978, the Ministry of Machine Tool and Tool Building Industry placed 350 orders for development of new component items, including 200 from the Ministry of the Electrical Equipment Industry and 90 from the Ministry of Instrument Making, Automation Equipment, and Control Systems. However, only 200 orders were accepted, and only 50 were assimilated into series production.

The unsatisfactory technical level of component items from these sectors is also evidenced by the ratio of the growth rates of the share of products of the highest quality category. Whereas, in machine-tool building it increased in 1981 in comparison with 1975 by a factor of 5, it increased by a factor of 4 in instrument making and by a factor of 1.5 in electrical equipment. The proportion of such products in the total volume of items in the sectors being analyzed was approximately equal. It can be assumed that expansion in output of high-quality products in machine-tool building has been provided for in large measure by scientific preparation for reproduction and accelerated updating of products within machine-tool building itself rather than by raising the proportion of high-quality component items provided by the electrical equipment industry and by instrument making.

In increasing the growth rates in expenditures for SRED work in machine-tool building and showing concern for the development of operating parts of machines, we should not forget about creating the necessary conditions for the scientific preparation for other parts of automatic machine systems. To accomplish this planned task, there is a need to formulate a scientifically based assumption about the level of development of scientific-research and planning-design work in the related sectors of machine building.

In providing a very general assessment of the scientific preparation for product reproduction in the industrial sectors that have been examined, it must be noted that scientific-research, planning-design, and technological work has been most successful in electrical equipment. In this sector, during the 10th Five-Year Plan, 70 percent of the new technology models on a yearly average were assimilated into production, but only 57 percent in instrument making and 38 percent in machine-tool building. At the same time, in the electrical equipment industry and instrument making, there was progress in the process of improving the final results of activities by scientific-research institutes and design bureaus. The ratio of the number of new technology items being assimilated into production to the number of those created increased most of all in instrument making. In machine-tool building, it worsened.

From what has been presented above, the provisional conclusion can be made that in instrument making and, especially, in machine-tool building, there are large internal reserves for improving the success rate of scientific and design work. An assessment made in 1979 of the technical level of new types of machines, equipment, apparatuses, instruments, and automation hardware created for the first time in the USSR showed that, in the proportion of technology models surpassing the level of domestic and foreign achievements, the Ministry of the Machine Tool and Tool Building Industry lagged other machine-building ministries, chiefly, instrument making and the electrical equipment industry. In the quantity of favorable decisions on the issuance of authors' certificates for inventions per 100 completed topics, the scientific-research, planning-design, and technological institutions of this sector occupied last place among organizations of the same type in other sectors of machine building. In instrument making almost every third organization among the institutes and design bureaus investigated received not one favorable decision on the issuance of an author's certificate for invention.

With respect to the sectors mentioned, it would be possible to recommend stricter requirements for increasing the effectiveness of scientific-research and design-technological work with lower growth rates in expenditures for its conduct. This would allow better satisfaction of the needs for products on a scientific-technical level surpassing world achievements.

At the November (1981) plenum of the CPSU Central Committee, L. I. Brezhnev said: "In accord with the draft plan, rates for updating technology will grow by a factor of approximately 1.5. This will place large and responsible tasks before scientific-research and design institutes.

"Unfortunately, far from all of them are operating as the present stage of scientific-technical progress requires. The proposed technical and technological solutions do not always respond at this level."*

Analysis shows that, in the electrical equipment industry, a certain reduction in expenditures for SRED work in the first half of the 1970's caused a reduction by 16 percent under the 10th Five-Year Plan of the number of new technology models created for the first time in the USSR and a retardation in growth rates of products of the highest quality category in the total volume of items being manufactured.

In the production sphere, the quantity of new technology models assimilated for the first time went down by 8.3 percent, in comparison with the 9th Five-Year Plan; the proportion of products assimilated for the first time in the USSR went down from 3.2 percent in 1970 to 2.2 percent in 1980. If one is oriented toward the natural-material side of the results received from investments in SRED work, there was a trend by the end of the 1970's toward a retardation of scientific-technological progress in the electrical equipment industry.

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* PRAVDA, 1981, 17 November.

In the 10th Five-Year Plan, the average yearly growth rates in expenditures for SRED work went down in the sector by a factor of more than ½. At the same time, the system of organization for such work was more developed. Suppose that further intensification of scientific-research, planning-design, and technological work compensates for the worsening in supply and equipment conditions for their conduct, there are still inadequate grounds. Under the 11th Five-Year Plan, the trend for slower scientific-technical progress will be maintained if measures are not taken to change the conditions for scientific preparation for product reproduction in the electrical equipment industry.

Increased expenditures for scientific-research, development, and preparation of models for new types of machines, equipment, instruments, and apparatuses with improved technical-economic parameters cannot provide the needed effect in the economy in the presence of continued long periods for assimilating them into production and saturating it with new technology to an economically sound level.

As already noted, problems in the organization of production for new types of machines, equipment, instruments, and automation hardware are being solved too slowly. According to this parameter, machine-tool building is ahead of the electrical equipment industry and instrument making. Thus, in 1979, in machine-tool building, production was started on 38 percent of the new technology models created and adopted for assimilation; in instrument making, 31 percent; and in the electrical equipment industry, 24 percent. The proportion of new technology models grew in which production start-up was planned for the third or later years after their creation.

As the result of slow assimilation into production of new types of items, there has been a decrease in the share of products assimilated in the USSR for the first time. With respect to the level of updating products being manufactured, the electrical equipment industry and instrument building lag machine-tool building. The share of products assimilated during the last five years, in the total output of products in the Ministry of the Machine Tool and Tool Building Industry in 1980, was 48.9 percent; in the Ministry of the Electrical Equipment Industry, 40.5 percent; and in the Ministry of Instrument Making, Automation Equipment, and Control Systems, 47.2 percent. If one considers that obsolescence among instrument products takes place more rapidly than in machine-tool building, an equal share of updating actually shows a large lag in updating instrument-making items.

Without going more deeply into the treatment of the problem, one can only note that the utilization of the unified fund for financing scientific-research, planning-design, and technological work and expenditures for preparation and production assimilation of new and updated types of products, and also increased expenditures in the first and, in individual cases, second year of serial production of manufactured items substantially varies among ministries transferred under the 10th Five-Year Plan, to the new system for planning, financing, and economic incentives. In this connection, in the composition of the unified fund, the higher proportion of new technology models, the production of which was begun in the year of their creation, corresponded to the larger share among the means directed toward assimilation and introduction of innovations in the Ministry of the Machine Tool and Tool Building Industry in comparison with the Ministry of the Electrical Equipment Industry.

Therefore, in the Ministry of the Electrical Equipment Industry, the decline by almost half in the growth of means from the unified fund for the development of science and technology directed toward the financing of new technology measures was little justified. The practice that has evolved in the sector of utilizing means from the unified fund for financing scientific-research, planning-design, and technological work (65%) and for the assimilation and introduction of progressive technology (35% of the total sum) requires correction on the side of strengthening attention toward measures for introduction. The limitation in growth of the unified fund in the electrical equipment industry in strict accord with increase in volume of expenditures for SRED work seems insufficiently sound. It seems that the normative for deductions for the unified fund in this sector should be raised somewhat.

The measures worked out for improving planning are based on the wider utilization of normative methods already during the current five-year plan. Their application in planning and financing the scientific preparation for industrial product reproduction assumes deeper scientific study of the progressiveness of normatives in the ministries and in USSR Gosplan at the stage when the five-year plan is being drafted. The introduction of a system for scientific substantiation of technical-economic norms and normatives requires a transition to a qualitatively new level of plan content and more precise determination of priorities in the development of scientific preparation for product reproduction in industrial sectors to provide progressive changes in the technical level of products being manufactured and in increasing the effectiveness of social production.

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MORE INCENTIVE NEEDED FOR ACADEMY SCIENTISTS TO INTRODUCE NEW TECHNOLOGY

Moscow SOVETSKAYA ROSSIYA in Russian 4 Feb 82 p 2

[Interview with Professor M. M. Zaripov, chairman of the presidium of the Kazan' Affiliate of the USSR Academy of Sciences and a doctor of physical-mathematical sciences, by a correspondent of SOVETSKAYA ROSSIYA: "Evaluation According to the Effect"; date and place not specified]

> [Text] Science in Tataria is four academy institutes, 15 VUZ's, over 70 technological and design scientific-research institutes for economic sectors, occupying 15,000 scientific workers. During the past five-year plan, the academy institutes alone completed a large amount of research. When introduced into the economy, it brought over 18 million rubles in economic effect.
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> The achievement was significant. But how can this effect be made more significant and how can the assimilation of developments in production be accelerated? Professor M. M. Zaripov, chairman of the presidium of the Kazan' Affiliate of the USSR Academy of Sciences and a doctor of physical-mathematical sciences, discussed this with our correspondent.

[Zaripov] It is necessary to begin with the obligatory planning of the utilization of scientific products. If science is obliged to carry an idea forward to the production line, the economic sector, in turn, should bear responsibility for utilizing the discoveries on which time, money, and material resources have been spent. Ideas, discoveries, knowledge are the same as products, and they must be utilized as soon as possible, without delays. In order not to be making unsubstantiated statements, I will introduce an example. In our Institute of Organic and Physical Chemistry, interesting pharmaceutical preparations have been created on the basis of organophosphorous compounds. Patents have been received and many favorable comments, but you can't find the powders, pills, or ointments of the Kazan' scientists in hospitals, polyclinics, or pharmacies. The scientific collective does not work for the pharmacies, but for the archives of the Ministry of the Medical Industry. Of 12 new medicines from the Kazan' scientists, only two are being manufactured. The first part of the program was planned and funds were allotted for it and, when physicians asked that development be accelerated, the Ministry of the Medical Industry undertook responsibility for organizing the production of medicines at their enterprises. But, beyond the promises, nothing happened.

[Question] What can usefully be done to increase the motivation of scientists and scientific collectives to intensify research and more rapidly advance scientific-technical ideas?

[Zaripov] The country is accomplishing large tasks relating to the development of productive forces. To expand the contribution of science to the acceleration of scientific-technical progress, there must be a unity of material and psychological incentives for scientific creativity, and encouragement not only for the quality of research and lengths of time for developments, but also for its practical effectiveness. I will not discuss ministerial scientific-research institutes -- they have their own specific character. But, in our opinion, the criteria that encourage the results of activity by academy scientific centers, where the most qualified scientific personnel are concentrated, are in need of improvement. Funds for research are now allotted from the budget. The share that will go for wages is known. An incentive fund is being established -- 6 percent of the wage fund. This is a completely incorrect guide -- to put incentive in direct proportion to expenditures. Doesn't it appear that you have to spend more so that the incentive will be greater?! It is not even a matter of what percent goes into incentives for scientific creativity; in principle, this sum can be either more or less. The most important thing is that the percentages of award funds are not related to the end economic effect, generally, introduction into production. Without the implementation of an idea, scientific work makes no sense; however, there is practically no incentive for the activity of scientists of academy scientific centers in the process of advancing developments into the economy. Collectives of industrial enterprises, depending on work results, have funds for the development of production and improvement of social and everyday environment. Why is such a rule not applied to incentives for effectiveness in scientific creativity?

In accord with the decree of the CPSU Central Committee and USSR Council of Ministers "On Improving the Planning and Strengthening the Influence of the Economic Mechanism on Increasing the Effectiveness of Production and Work Quality," scientific-research, planning-design, and technological organizations, experimental enterprises, and scientific-production and production associations of the industrial ministries are being transferred to the cost-accounting system for organizing work in the creation, assimilation, and introduction of new technology on the basis of commission-orders. These orders, from the very beginning, determine the end research results, above all, the economic effect, the performers, and the lengths of time for accomplishing work at all stages -- from scientific research to the introduction of the results into the economy -- and also the necessary material resources, the amounts and sources of financing, and material incentives.

However, academy scientific centers remain in a special position -- they cannot work by contract because they have other goals. Scientific research and development are organized differently, on the basis of a preliminary plan and economic parameters determined earlier. Why is the work of scientists, academicians, and doctors not encouraged in relation to the economic effect achieved and the special achievements? It would be useful to establish a defense of authors' rights for academy scientific centers and to provide them the opportunity to receive part of the funds saved by introducing their discoveries into the economy.

Producers now present academy institutes with a statement about the economic effect received. I, personally, have a strange feeling when I read such documents with their figures on savings and other indicators, because these business papers, it would seem, are not followed by economic shares or, let us say, transfer of some of the funds to the scientific institution that developed the idea for the technology, instrument, or machine that was created.

The interests of scientific-technical progress require changing the approach to science management and increasing the authority of this vitally important sector of our state.

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BUREAUCRATIC RED TAPE BLAMED FOR HINDERING IMPLEMENTATION OF NEW TECHNOLOGY

Moscow SOVETSKAYA ROSSIYA in Russian 8 Jan 82 p 2

[Article by V. Ogurtsov, special correspondent of SOVETSKAYA ROSSIYA, Perm': "Recognition Takes Too Long: Reflections on the Reasons for Red Tape in Introducing Technical Innovations"]

> [Text] Petr Andreyevich Bykov gave himself a serious task: even if, to begin with, only to satisfy himself as to why casting with crystallization under pressure (LMKD) dragged on for over 40 years under the heavy chains of problems and how persistent and insoluble these problems were. At the time of our first meeting, he had looked for the answers to these questions of his for 12 years, had received 24 author's certificates, defended a candidate dissertation and, with all this, in search of realizing his idea in metal, and not just verbal support, he patiently trod from ministry to ministry, sent them drawings, estimates, diagrams, the most detailed letters . . .

The superiority of LMKD was recognized by casters over 40 years ago. This is the same type of casting that greatly increased the durability of casts and the resistance of metal to the effects of high temperatures and rust, lowered the cost of equipment by a factor of 2 to 5, and shortened the cycle of its manufacture. Of each ton of molten metal, only a tenth was wasted, when with traditional technology, inversely, 90 percent of the molten metal goes into runners and risers during casting, cinders, and shavings and scraps during thermal and mechanical treatment. And, at the same time, it was rather complicated to achieve guaranteed quality with each casting. The amount of detail and types of melts had to be selected with serious limitations, and the type of casting required serious knowledge and high technological discipline.

In 1964, the process found application in large-series production at 150 plants around the country that manufactured over 200 denominations of components from nonferrous alloys, iron, and steel. However, in the ensuing years, many enterprises began to turn away from LMKD. The main reason for this was the lack of improved equipment. The hydraulic presses and furnaces for heated metal did not permit melting it in a vacuum and measuring the input without contacting atmospheric gases.

Despite this, the casting method is alive and "operates" extremely successfully at Leningrad plants. At the "Bol'shevik" plant, for example, with the aid of a special press, the only one of its kind, excellent nonferrous casts have been produced for many years. The Voronezh Plant for Ore Concentration Equipment has been producing components of steel. In Gor'kiy, the automotive plant workers have made four facilities and have been "charged" with bulk casting of aluminum. Work is continuing in certain other cities in the country. The equipment is purely "self-made," and often it happens that an engineer from one plant finds the way to a dead end, while a designer at another enterprise, having no knowledge of the first case, is starting down the same path.

At each production "home" of the LMKD process, there are individual, isolated groups of scientists, most often from polytechnical institutes and ministerial scientific-research institutes, who did a little work and then gave it up, like the Voronezh Experimental Scientific-Research Institute for Forge-Press Machine Building or the Kramatorsk Scientific-Research and Design-Technological Institute of Machine Building, and who have just begun to try again, like the Odessa Scientific-Research Institute for Special Casting Methods or the Moscow Scientific-Research Institute for the Technology of Tractor and Agricultural Machine Building.

After the CPSU Central Committee and the USSR Council of Ministers adopted the decree "On a Significant Rise in the Technical Level and Competitiveness of Metal Treating, Casting, and Wood Processing Equipment and Tools," we decided to attract attention to the LMKD problems. The hopeful attempts of the Perm' scientist, P. A. Bykov, became grounds for solving one of them. In particular, convinced of the unsatisfactory state of existing equipment, Bykov proposed a design for an extremely universal, new press and a new casting machine.

The report "Walking Around with a Discovery," published in August 1980, brought out the outrageously indifferent attitude of representatives of various ministries, agencies, and institutes from which he had asked for support. And we hoped that our concern on this matter would be shared by managers in the USSR Ministry of the Machine Tool and Tool Building Industry, the USSR State Committee for Inventions and Discoveries, and the RSFSR Ministry of Higher and Secondary Specialized Education, the latter representing the system in which P. A. Bykov works.

But their reactions to the newspaper statement deserves detailed comment.

. . . The Ministry of the Machine Tool and Tool Building Industry did not first hear of Bykov from the newspaper, of course. Many times he had sent letters to all kinds of levels in the hope that somewhere within the ministry which, in recent years, had often reproached the imperfection of machine tools and machines put out by the sector, a proposal could be evaluated on its merits. Again the newspaper made a statement (and this at once has a multimillion-sized readership that awaits a businesslike and direct answer from the ministry!) and, perhaps, it is unnecessary to recall the degree of responsibility with which the question raised should be followed up.

However, the answer received by the editors, which was signed by the deputy chief of the technical administration of the USSR Ministry of Machine Tool and Tool Building Industry, V. I. Potapov, just raised new questions. Then, on the newspaper's initiative, a meeting took place. The managers of the scientific-research institutes that, at one time, had "reviewed" the proposals and their author, P. A. Bykov, were invited. And here, in a conversation on the topics of ethics and new technology, necessary clarification was finally introduced. For example, it was explained that the "broad array of universal press equipment" assimilated by the industry, to which the ministry referred in almost every response, practically did not apply to LMKD (it was inconvenient to the casters) and, against this background, the press proposed by Bykov and the ones being stocked were not the same and, in some areas, had several obvious advantages.

The participants in the long discussion became witnesses to a truly surprising thing. It turned out that the Voronezh Experimental Scientific-Research Institute for Forge-Press Machine Building -- the basic designer and planner of forge-press equipment -- was deciding the fate of this invention as if, in general, it paid no attention either to originality of design or to obvious advantages connected with it. And did they look at the drawings, crossing out the strange concepts? The head of the institute sector, O. Protopopov, had only to shrug his shoulders. Despite him, V. Potapov had already signed an answer to the editors:

"Such a press is needed by industry, even if it is looked at separately from the casting machine. It, of course, must be made, and we are prepared to facilitate this."

It turned out that lining the press-forge with graphite powder also made sense. The Odessa NIISL [expansion not available] undertook to study and test this proposal. No one, as much as one could understand from the conversation, now categorically crossed anything out. And Bykov turned out to be extremely knowledgeable and prepared for this conversation as an engineer. And yet, see how many years went by, how much paper went back and forth, and how many organizations callously assigned it the fate of a "strange" idea! How much effort and nervous energy were needlessly wasted by Bykov himself, whose basic work was teaching at a university department of industrial economics!

And what about the other agencies?

The USSR State Committee for Inventions and Discoveries decided that this was not a case where it was necessary to state its opinion to the newspaper and its readers. And when our reader from Bratsk, A. A. Zverev, sent a comment not to the editors, but to the committee, recalling the correspondence that had been published and that the problem that Bykov was working on was indeed urgent, another rather funny thing happened. The head of the metallurgy and mining industry section, A. P. Potrusayev, contrived to read this letter as if he considered Zverev himself the author of the research and proposed to him in writing that he remind the committee of the number of the author's certificates and a list of inventions on the subject. And this was when he could have taken a second to look in the bibliographic directory or computer just as rapidly and exhaustively answer all the questions that he had -- if they had looked for them not for the sake of answering the correspondence, but for the substance.

The Russian Ministry of Higher and Secondary Special Education "did not read" the first report that told how Bykov, the university teacher, having received author's certificates, was going from one place to another with a good concept and could neither obtain any human support nor gain a ruble for its implementation. This was only a few months after the instructive meeting at the Ministry of Machine Tool and Tool Building Industry, when we were preparing to pay a similar visit to the Ministry of Higher and Secondary Specialized Education, that it was hastily filled with attention for the man and his technical foresight, having agreed to provide the necessary funds for this work.

This, it would seem, is the whole of this history. It is purely a "happy ending" [in English], as, today, Petr Andreyevich has everything necessary to implement his concept. There is money, there is the Perm' Mining Machine-Building Plant, which has started the manufacture of the equipment in metal, and there is agreement by the Ministry of Machine Tool and Tool Building Industry to provide aid in completing the hydraulic system.

As we see, all our conversation leads up to the fact that today, unfortunately, there is still not enough of the brave desire to fight "dead" technical problems and ability to courageously sustain long failure, knowing neither winter nor summer nor free hours from a private obsession. It is necessary, it appears, still to have much endurance, will, and self-control, even with obviously useful proposals, to get through the common red tape, the stereotyped thinking, and the inertia of a quiet yesterday.

But he who selflessly pursues his goal can only arouse respect. He not only makes important technical amendments, but, through personal moral example, shows and convinces others that it is this kind of attitude that will provide our future scientific and technical superiority. Such examples are always more convincing than any "naked" appeal to improve and to perfect. That is why they are responded to more fervently and practically.

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TECHNOLOGY BLAMED FOR POOR QUALITY OF GOODS

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 1, Jan 82 pp 88-94

[Article by G. Kulagin, senior scientific associate of the Leningrad Financial-Economic Institute imeni N. A. Voznesenskiy: "Putting Technology to the Service of the Economy -- A Discussion"]

[Text] The scales and achievements of the USSR economy are enormous. The country has taken first place in the production of petroleum, steel, cement, mineral fertilizers, tractors, railroad cars, commercial lumber, wheat, cotton, shoes, and many other important types of products. There has been immeasurable growth also in production potential, which has at its disposal the largest stock of machine tools in the world. In numbers of scientists and engineers, the USSR surpasses any other country.

However, the effectiveness in utilizing these colossal material and intellectual riches is not good enough. As L. I. Brezhnev noted in the Summary Report of the CPSU Central Committee to the 26th CPSU Congress, we spend per unit of national income more raw materials and energy than do other highly developed countries. This reflects the influence of a number of unfavorable objective factors: the exhaustion of old mineral deposits in long-exploited, thickly populated regions of the country, the drawing into economic circulation of remote deposits of the North and East, and also the exploitation of new lands in marginal agricultural zones. Within the next ten years, an unfavorable situation will develop with respect to labor resources, caused by remote consequences of the past war.

These circumstances dictate the necessity for avoiding the usual stereotyped economic thought and, as demanded by the party, provision for immediate transition from extensive methods for conducting the economy to intensive methods and for sharply increasing production effectiveness. " . . . Our future movement ahead, said L. I. Brezhnev in his report to the 26th CPSU Congress, "still in large measure will depend on skillful and effective utilization of all existing resources -- labor, plants, fuels, and raw materials, and products of the fields and farms."*

The fulfillment of these requirements, as it seems to us, depends first of all on the solution of three relatively independent problems: improvement in planning and in the economic mechanism as a whole, a more correct distribution of scientific and engineering-technical personnel, corresponding to the real needs of the economy, and all possible acceleration of scientific-technical progress.

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* "Materialy XXVI s"yezda KPSS" [Materials of the 26th CPSU Congress], Moscow, Politizdat, 1981, p. 42.

The ways to solve the first problem were outlined in decrees by the party and government adopted in July 1979, and it is now a matter of more energetically and persistently than ever before to make them a reality. We would like to express a number of considerations in two other areas of improving the economy.

In 1980, the number of engineers occupied in the economy was over 4.9 million persons. The quantity of scientific institutions, including VUZ's, scientific-research institutes, and their branches and departments, was several thousand. A large part of these institutes are subordinate to economic agencies, that is, they are called upon to create new engineering and technology directly. In 1980, the country had 1.373 million scientific workers and the total number of workers occupied in science and science services was 4.379 million persons. More than half of the scientific institutions and scientific workers were concentrated in the fields of engineering, physical-mathematical, and chemical sciences and, consequently, were tied to the development of scientific-technical progress.

Science becomes a direct productive force only with the introduction of its achievements into material production through new technology, the specific carriers of which are new machines, apparatuses, and instruments. Therefore, data on the quantity of machines, equipment, apparatuses, and instruments that are being assimilated into series production provide an objective indicator of the real effect of the scientific-technical system on progress in material production.

At the present time, on a yearly average, 2750 technical innovations are assimilated into series production. This includes not only machine tools, rolling mills, and turbines, but also ammeters, manometers, and switches. If you take only half of the scientific workers whose activities are closely related to the creation of new technology, a simple comparison of the statistical data shows that 250 scientific workers work for a year on one innovation.

Even taking into account that among scientists are many teachers in technical VUZ's, whose basic business is teaching students, it must be recognized that the effectiveness of the scientific-technical system of the country is too low. And, you see, along with workers of scientific-research institutes and design bureaus there are also engineers who work directly at factories and in associations and, consequently, also take part in creating and assimilating new technology.

In addition, the technical-economic effectiveness of some innovations also leaves much to be desired: as was noted at the 25th CPSU Congress, they "are reported as 'new' but, in reality, are new only because of the date of manufacture and not because of their technical level."* The drop observed in return on funding is explained not only by the unsatisfactory utilization, due to a shortage of workers, of capacities recently put into operation. There is another, no less important reason. There are often cases where the cost of new machines, which are not bad according to their technical data, is growing much faster than their productivity and economic effectiveness. Mass application of such extremely expensive technology does not move the economy forward but, on the contrary, retards its development.

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* "Materialy XXV s"yezda KPSS" [Materials of the 25th CPSU Congress), Moscow, Politizdat, 1978, p. 47.

The main reason for such phenomena, in our view, is the unsatisfactory organization of the scientific-technical system and, most of all, the weak relationship between applied research and experimental-design developments, on the one hand, and production, on the other hand. It is a matter not only of organizational, but also economic interests, of incongruity of administrative interests of independent scientific-research institutes and design bureaus, on the one hand, and industrial enterprises, on the other.

In our opinion, the lack of clarity in the theoretical premises concerning the role of science in the scientific-technical revolution has had a large effect on the organizational evolution of scientific-research and experimental-design work.

K. Marx and F. Engels looked upon material production as a basis for the life of any human society and considered that it is the demands of society, first of all demands for material production, that are the moving force in the development of science. At the same time, they stressed many times that science itself becomes a direct productive force only insofar as its knowledge is assimilated by production.

During the "scientific boom" of the 1950's and 1960's, the second part of this conclusion was often dropped and science was proclaimed a direct productive force regardless of whether its achievements were assimilated into production. From here, it is a small step to the statements that a ruble invested in science yields a return in profit that is larger by a factor of 4 than the same ruble invested in production and that the more scientists there are, the better.

Proposals have appeared for a reexamination of the Marxist concept of the ideal worker. K. Marx introduced this concept, including in it not only workers, but also technicians, supervisors, and other persons who jointly create the final product that has use value or exchange value. At the same time, K. Marx made a distinction between joint labor and aggregate labor. In the latter he included even the labor of scientists who lived in the distant past insofar as the knowledge they attained was also utilized in production, although they did not participate in creating concrete value.

The expanding role of science and the growth in demands for general and specialized education for the modern worker in material production, and the increase in the proportion of persons engaged in intellectual labor are increasingly often becoming the basis for proposals to include new categories of laborers in the concept of the ideal worker because, they say, the knowledge attained by physicists, for example, will be used sooner or later in production, teachers train production personnel, and physicians are concerned with their health.

It seems to us that this expanded approach is not only inappropriate but also far from harmless in practice. Of course, science, education, medical service, culture, and art are extremely necessary and constantly growing forms of human activity that, in the final analysis, have enormous influence on the effectiveness of material production. But, at the same time, they develop at the expense of the surplus product created only in the sphere of material production. The distinct boundaries of the concept, firmly established by Marxist theory, cannot be washed away, thereby confusing the sphere that produces national income with the sphere that uses it.

Such an extreme point of view, which looks upon even a theoretical physicist as a productive worker, contradicts the practice of planning and financial bodies which long ago put scientific-research and design organizations directly tied to the creation of new engineering and technology into the nonindustrial group. Thereby, a large army of engineers were artificially related to science and withdrawn from the concept of ideal worker. Is there not legitimate bewilderment as to why, let us say, workers whose duties consist of creating and improving new turbines, boilers, and machine tools are put into the nonindustrial group along with astronomers and literary experts?

Even the design services of "Uralmash," "Elektrosila," and the Neva Machine-Building Plant imeni V. I. Lenin now have acquired institute status and have ceased to be counted as industrial personnel. Of course, a certain bureaucratic goal played a role in these transformations: by removing technical units from industrial personnel, the ministries formalistically improved the labor productivity indicator. However, a reverse process takes place, because one of the chief obstacles is removed with respect to economically unsubstantiated expansion in the staffs of these "independent" institutes. And the main thing here is that, in raising purely technical units to the rank of scientific units, we cease to distinguish between science and technology.

To be sure, during the century of the scientific-technical revolution, it is difficult to delimit research as purely scientific or as development of new technology. Nevertheless, such distinctions are necessary. The thing is that the chief task of science is to produce new knowledge and to understand new laws of nature, society, and intellect. Technology, on the other hand, is called upon to advance the economy directly. Large scientific discoveries that serve as a basis for conceptually new technological trends are accomplished not very often, not according to previous plan, and not during a prescribed period of time.

Technology develops continuously and it is built not only on new scientific discoveries, but also on purely engineering, inventive creations. In distinction from science, the probability of achieving positive results in technology is near unity and, therefore, its achievements should be planned. Science, in a certain sense, is a noneconomic category and is rightly provided for by the state because it works for the future.

It is not always possible to say when a scientific discovery will be utilized in practice. It is even more difficult to predetermine the economic effect from its application. On the other hand, scientific knowledge, once achieved, is utilized in technology over and over again and, as K. Marx again pointed out, it "doesn't cost a thing" for the specific producer. In this is manifested science's gift to labor. Even today, engineers make everyday use of the laws discovered by Archimedes, Newton, Ampere, and Mendeleyev.

It is different with experimental-design developments and developments related to other applied research. If they are not pioneers, that is, the first to use new laws discovered by fundamental science in technology (and a majority of technical innovations take place exactly this way), it is possible to evaluate and calculate the economic effect from their application and to correlate expenditures and results.

Technology is an eminently economic category. A new machine that does not provide a saving concretely expressed in rubles is unneeded and, moreover, is harmful. Naturally, this does not include cases where technology is created to protect people's health or natural environment.

The extremely common but, to us, somewhat onesided understanding of the nature and sources of technical progress promotes contusion of the task and statute of science and technology. Many specialists in science consider that technical progress develops only according to the pattern of "fundamental scientific discovery--applied research--experimental-design development--and series production." In reality, it often occurs this way. This is the way, in the 20th Century, that developments have taken place in atomic energy, polymer technology, semiconductor production, and computers. In the past, there also appeared the telephone, electric motors, and radio.

But this pattern is not the only way. Often, new technology, including technology that is new in principle, is created or improved on the basis of engineering-design or inventive creativeness, which is not the same as a scientific basis. Again, F. Engels introduced the example of the invention of the sewing machine. No proof is required that this great invention produced such a revolutionary change in a very important branch of industry -- the production of clothing -- that it is difficult to find a counterpart among the innovations of our epoch of scientific-technical revolution. Meanwhile, the sewing machine was not related to the latest achievements of science of that time: it simply united the needle that had existed for thousands of years with a mechanism for transforming rotating movement into back-and-forth movement that also had been known for hundreds of years. But the main expression of the genius of its creator lay in that he made a guess about moving the eye of the needle from the rear to the front. The steamship, steam locomotive, railroads, and airplanes also came about in this way. Their creators were not scientists, but engineers and inventors. It is worth remembering that such coryphaei of world and domestic technology as the Wright Brothers, Lumiere, Popov, Marconi, Tupolev, and Korolev were, above all, engineers and designers.

Some authors maintain that it was this way earlier, when only production requirements pushed technology forward, but that now, they say, science has moved ahead, and technology develops only on the basis of science's latest discoveries. It seems that such statements not only depart from well-known Marxist positions, but also do not correspond to the facts. It is sufficient to name such genuine innovations of the second half of the 20th Century as ballpoint pens, vessels that ride on underwater wings or on air cushions, helicopters, and shuttleless weaving machines. Or, for example, take such types of engineering and technology as automotive construction, turbine building, ferrous metals production that, for many decades, have developed on account of progress in engineering thought, but on the basis of old scientific thought. The designer and technologist, in our view, are always chief figures in the technical improvement of production.

Thus, the confusion of tasks and status of the scientist and the engineer are a primary reason for a number of mistaken organizational measures that get in the way of rational and full utilization of our enormous scientific-technical potential.

The assignment of design and other engineering units of industrial enterprises to the status of independent institutions, operating under cost accounting, with many being raised to the rank of scientific-research institutes, in our view, has had negative consequences for technical development. In this situation, there has been a certain devaluation of both scientific and engineering work. In individual institutes, under the influence of requirements for immediate economic effect, there has been a splitting up of topics and the dissipation of efforts on the accomplishing of current tasks. These institutes, not having stuck to their business, have begun to grow excessively and are often filled with people who do not have the essential qualities needed for scientific work.

Raising engineering activity to the rank of scientific activity has lowered the prestige of concrete design work, has offered engineers of many agency scientific-research institutes the gratuitous status of "free creators," and has changed many of them from producers of surplus product into its consumers. The concentration of the most creative part of the technical intelligentsia into independent institutes lowers the intellectual level at enterprises and leads to a decline in the prestige of the factory engineer.

But the chief deficiency of the existing organization of scientific-research and experimental-design work is that the cost-accounting interests of independent scientific-research institutes and design bureaus and the interests of production enterprises inevitably take different directions and, sometimes, they are directly contradictory. That is why, after new technology is created, its introduction into production often becomes a severe bottleneck, that is, the unified process essentially tears apart.

The enterprise or association that works by someone else's documentation is not responsible either morally or legally for the quality of the assimilated products: they can always refer to errors and gaps in the documentation received. And during the periods of assimilation, their responsibility for the same reason is very conditional.

On the other hand, scientific research institutes and design bureaus that do not have their own production base, cannot guarantee high quality for their developments, because there is no basis for judging their true value and economic effectiveness until the planned machine is embodied in metal and is put into operation by users.

Because of this, widely applied cost accounting in independent applied scientific-research institutes and design bureaus is theoretically and practically groundless. Their products -- reports and drawings -- are the products of a "private worker" (the use value of which remains unrevealed until it is assimilated into production), and therefore cannot and should not be looked upon as goods output. And to determine the socially necessary labor expenditures on a draft for a new machine is practically not possible. Cost accounting of a design bureau, which is based on payment for documentation according to price lists made-up in dependence on format and complexity group of the drawing, as many years of practice show, only causes unnecessary complications and too many types of machines. For example, at one time, Leningrad machine-tool builders turned out so-called processing centers according to drawings from a design bureau operating under cost accounting. The machine contained 2500 denominations of parts. Some time later, the Ivanovo Plant for Cutting Machine Tools (now the Heavy Machine-Tool Building Plant imeni the 50th

Anniversary of the USSR), in competing with the Leningrad plant, also undertook production of this kind of equipment. In accumulating experience, it studied a foreign counterpart: in it there were only 800 denominations of parts.

It appears also that the system is not very good for paying for commission-orders out of unified funds for the development of science and technology for the final results. What can be considered a final result? A finished machine and the user's economic effect? But the time from the beginning of research and design to the proving of new technology by the user, in a majority of cases, takes 5 to 6, or even more, years. This means that scientific-research institutes and design bureaus have to resort to advances and credit because, as a rule, they do not have their own working funds. In reality, this inevitably leads to payment for "estimated effect," with all of the undesirable consequences that come with it.

And there is yet another negative aspect to the independent existence of new technology developers. It is known that scientific-research institutes absorb the basic mass of graduates from technical VUZ's. The young specialist, finding himself in an institute and having no contacts with production, loses his "taste for metal." As a result, the number of creative engineers is reduced and their professional qualifications go down. Let us introduce a characteristic example. During the war, three design bureaus were evacuated from a Leningrad plant. Two of them, after the blockade was ended, returned to Leningrad and again joined the ranks of plant collectives. The third -- the most qualified and with strong traditions -- also returned to the city, but preferred to organize an independent firm. At the beginning, while the old staff members were still alive, everything went well but, as generations changed, the quality of the documentation from this bureau began to fall noticeably and the number of elementary errors in drawings sharply grew.

It is both possible and necessary to overcome deficiencies in the organization of scientific-research and experimental-design work. The 26th CPSU Congress demanded improvement in the organization of the whole system of scientific research and indicated that it should be more flexible and mobile and that it should not tolerate nonproductive laboratories and institutes. "The decisive, most urgent sector today," stress the Congress's materials, "is the introduction of scientific discoveries and inventions into production. Scientific-research and planning-design work must come closer together -- economically and organizationally -- with production."*

Specific ways to accomplish this task are well known: the course outlined by the party must be followed in creating powerful scientific-production and production associations that include design bureaus and applied scientific-research institutes along with factories or plants. However, in many cases, this task is accomplished formalistically. Sometimes, they simply change the sign and, not doing anything new to the organization, rename an existing organization or factory as an association.

Often, reorganization is limited to creating a formal organizational entity (general management board) while preserving economic disunity. An institute included in an association is counted, as before, as belonging to the "nonindustrial group," has its own plan, its own labor and staff limits, independent sources of financing, and even the rights of a legal person. Is there any surprise that, with such an approach, there is no achievement of the chief aim of the reorganization -- the creation of a unified complex operating under cost accounting and providing for the unity of economic interests between developers and producers? The former, as before, receive money not for a finished product, but for drawings and reports and for fulfilling topic assignments.

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* Materialy XXVI s"yezda KPSS" [Materials of the 26th CPSU Congress], p. 43.

The creation of such associations complicates the structure of management and planning, increases the flow of unneeded information and staffs of management personnel, and retards decisonmaking.

More advisable is the system for organizing scientific-research and experimental-design work represented by the following organizational picture. There should be independent existence, in our view, for academy institutes occupied in fundamental and pioneering applied research on a large scale, the aim of which is the utilization of new scientific ideas in practice. Such research includes, for example, the creation of fast breeder reactors or thermonuclear sources for producing energy.

Those applied institutes should be independent that solve large problems of interest to more than one economic sector, but under the condition that they will have their own production base adequate for implementing their ideas in practice. A good example of this kind is the Institute of Electrical Welding imeni Ye. O. Paton which, although considered an academy institution, is essentially a brilliantly operating engineering firm.

Under industrial ministries, it would be advisable, from our point of view, to create relatively small institutes, but staffed with highly qualified personnel. Their chief tasks would not be independent development and specific scientific research, but liaison with "big science," the coordination of activities of associations in creating new technology, providing expertise, and confirmation of new items for serial production, collection and processing of information on the status and development of world technology in the appropriate fields, and the development of standards, parametric series, and other methodological documentation.

It would be advisable to include the remaining institutes, first of all, design bureaus engaged in specific developments of new techniques and technology, as parts of scientific-production and production associations and to include their personnel as part of the "industrial group" and of production collectives. As an example, the Leningrad Optical-Mechanical Association (LOMO) was introduced at the 26th CPSU Congress as an organization of confirmed effectiveness. At one time, its managers showed a good deal of firmness in preserving and expanding the collective's scientific-technical potential and not allowing the isolation of creative subordinate units in independent institutions. This proved to be fully justified. LOMO products, as a rule, are equal to the best foreign models, and a unique piece of technology, a telescope with a mirror diameter of 6 m, has no equal anywhere in the world.

All new items in the association are developed independently, through the efforts of its own central design bureau, with minimum dependence on outside scientific organizations. Of course, LOMO produces not only astronomical instruments, but also smaller pieces, though the difference is persuasive.

Another example is the Leningrad Metals Plant imeni the 22d CPSU Congress, which works on documentation created by its own design bureau and laboratories. Its products are the largest hydroturbines in the world and unique steam and gas turbines. According to their size, complexity, and labor content, these systems many times exceed the average level of innovations reflected in statistics. Nevertheless, the labor content of one development is also one half that of the national average. Hydroturbines created by the Metals Plant, operate successfully not only in our country, but also in Egypt, Canada, India, Brazil, and Argentina; and it surpasses counterpart foreign machines in a number of parameters.

Instructive also is the experience of "Svetlana" in Leningrad where, in our view, the integration of science and production has been more complete. The association, which makes many types of products, has divided its vast administration into a series of scientific-production complexes that have been granted a large degree of independence and responsibility. Each complex includes a research base, design-technological units, and shops for series production. As a result, the quality of innovations went up sharply and the lengths of time for assimilating new items went down to one to two-thirds of what they were before. From our point of view, a deficiency in the association's structure is that the developers there are counted in the "nonindustrial group."

The advisability of the cited organization for scientific-research and experimental-design work is confirmed not only by our own experience but also by that abroad. Fundamental science abroad, as a rule, is done by universities, scientific societies, and state institutes. Investigatory applied research is concentrated in central laboratories of large companies. Concrete developments of new technology and experimental-design work are entrusted directly to large plants or to sections, operating under cost accounting, of so-called profit centers, which are analogous to our production associations.

With respect to the financing of new-technology developments, it seems advisable (so that it would always be economically effective) to have the most rapid transition possible to a normative distribution of profit and the introduction of these normatives to every large association. The development, assimilation, and also the acquisition of new technology should obligatorily be produced at the expense of the association's own means or of bank credits repaid from the same means.

An exception must be made only for fundamental research and for pioneering developments of technology that is new in principle. It is understood that Tokamak projects and similar research will always need state support and, until they lead to fully anticipated results, they must be done within the framework of independent scientific-research institutes that are financed from the state budget or from other centralized sources. To require such institutes to pay their own way would be unjustifiable. But it is no less justifiable to use means from the state budget to pay for ordinary research relating, let us say, to raising the efficiency of a routine pump and consider this scientific work. Even if such research is accomplished by outside organizations, it must be paid for out of the profit of the basic production and not out of state allocations for scientific research work as is now done.

It is no less important that new equipment for all operating enterprises also be acquired out of their own means (amortization plus profit) which are left to them in sufficient amounts for regular renewal of the basic plants. In this procedure, a powerful "inverse relationship" arises from the user of new technology to its producer. Control of price formation is eased, and economically unfounded growth in prices for new machines is curtailed. The amount of new construction is also reduced -- reconstruction of existing enterprises receives priority. Such a development will fully correspond to the decisions of the 26th CPSU Congress.

At the present time, as the data introduced above indicates, a clear overproduction is observed of individual groups of engineering-technical workers with a growing deficit of workers without whom any very advanced technology would be dead capital in plants and factories. In this connection, it seems advisable in the next few years to take a number of measures in the field of training and utilizing labor resources, in particular:

-- to transfer a large portion of technicians to the training of workers with higher qualifications, since now there is a need for technicians of a new type capable of accomplishing the complicated work of adjusters, aligners, and control-panel operators;

-- to increase the enrollment of young people in secondary vocational-technical schools and to permit their graduates to take examinations for VUZ entrance on an equal basis with graduates of ten-year schools and even give them an advantage if they enter a VUZ in their own work specialty;

-- to cut back enrollment in day-class departments of VUZ's in specialties where there is no shortage and to make stricter requirements for the selection of students, with consideration for the appropriateness of each specialty selected, and to raise standards in the specialist training process; and

-- with the aim of reducing the use of specialists with higher education in secondary work and also of strengthening the labor experience of young people, to expand the training assignments in worker's positions in agriculture, industry, construction, and other sectors of the economy. In this connection, it would be advisable to lengthen the periods of VUZ study so that each student would spend a year minimum in a worker's position close to his chosen specialty. This measure would partially affect the provision of labor resources to production and would permit young specialists to verify their choices more deeply.

The creation and effective utilization of new technology requires the most rapid possible fulfillment of party decisions on bringing science and production closer together. For this, it is necessary above all to expand the self-dependence of associations and enterprises and the rights and responsibilities of their administrative managers.

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BETTER COORDINATION NEEDED IN UZBEK R&D

Tashkent EKONOMIKA I ZHIZN' in Russian No 12, Dec 81 pp 2-4

[Editorial: "To Strengthen the Union of Creative Thought and Creative Labor"]

[Text] A powerful factor in creating the supply and equipment base for communism and a reliable tool for strengthening the economic and defense power of our Motherland and for the growth in the well being and spiritual riches of the Soviet people is what we say today about science, which has truly become a direct productive force in the society of mature socialism.

The large army of scientists in Uzbekistan are striving to keep abreast of the times. With their direct participation just during the years of the past five-year plan, 4000 types of new industrial products were assimilated into production; over 14,000 units of equipment were modernized; and over 1000 mechanized and automated production lines, about 50 automated control systems for technological processes, systems, and facilities were put into operation. The average yearly economic effect from introducing all these innovations was almost 400 million rubles, and roughly the equivalent of 35,000 released workers was achieved.

From the high rostrum of the 26th CPSU Congress were noted the achievements of science in our republic in the study of the patterns of heredity and in the creation of new highly productive strains of cotton plants and of defoliants that are not very toxic, for effective utilization of the plant, mineral and raw material, and fuel-energy resources.

Scientists' aid to rural workers takes many forms. Along with bringing out increasingly valuable cotton plants, they create complex fertilizers with microelements and effective herbicides; they develop biological methods for fighting agricultural pests; and they are improving cotton harvesting technology.

Just a little over two decades ago, the first nuclear reactor in the Soviet East was started up in Uzbekistan. Today, the results of research by our physicists are widely applied in industry and agricultural production and in environmental protection.

The president of the USSR Academy of Sciences, Academician A. P. Aleksandrov, has had high praise for the activities of the Institute of Nuclear Physics of the Uzbek SSR Academy of Sciences.

An Uzbek SSR State Prize imeni Beruni was awarded this year for a cycle of scientific-research projects by a group of scientists for the creation of a theory of earthquake-resistant construction and scientific-methodological foundations and maps of seismic regionalization and subregionalization of the territory of the republic. The results of this research has been used successfully in the construction of the Tashkent Subway System imeni V. I. Lenin and has well proved itself in the construction of many civil and industrial buildings, particularly along the Baykal-Amur Mainline and abroad.

A discovery by the scientific collective of the Scientific-Research Institute for Construction Materials has enormous economic significance. In cooperation with producers, a conceptually new type of cement -- alinite -- was created here. Its basic merits are increased strength in comparison with the best grades of Portland cement and significant reduction of energy in production. Fuel savings with this technology, called low-temperature technology, reach 30 percent, and the productivity of the baking furnaces has increased by a factor of almost 1.5. According to preliminary calculations, Tashkent alinite will provide, during the next ten years, an economic effect of about 1.5 million rubles.

It would be possible to introduce many other examples that show important achievements by academy, ministerial, and VUZ science in Uzbekistan. All this, however, should not placate anyone, because the output of science, its contribution to the economy, could be much greater if we were to eliminate serious omissions and blunders in the organization, planning, and coordination of scientific research. This was talked about with directness and principle at the 26th CPSU Congress and the 22d Uzbekistan Communist Party Congress.

Therefore, the party has also posed the task, under the 11th Five-Year Plan, of subordinating the development of science and technology still more to the solution of important problems in the further progress of Soviet society and to the acceleration of the transition of the economy to the path of intensive development. The general secretary of the CPSU Central Committee, Comrade L. I. Brezhnev, declared at the congress that science must become "the perturber of tranquility," revealing the sectors where stagnation and backwardness have been noted and where there is a possibility to move ahead more rapidly and more successfully."

Unfortunately, the activities of certain of our institutions are far from responding to these demands. We have individual laboratories and even whole institutes that have no output and have turned into dependents of the state budget.

Our journal has already written this year about large omissions and obvious errors in the work of the academy physical-technical and electronics institutes. Thus, out of seven contract projects, the "Cotton Physics" laboratory of the Institute of Electronics was able to complete only one, although it spent tremendous amounts of time and 900,000 rubles on the research. The work output of the scientific associates of other laboratories of the same institute is also small. As a result, during the last three years, the average economic effectiveness here has been 26 kopecks per ruble of expenditure.

And in the scientific-research institute of cotton cellulose technology and chemistry, the return is still lower. In its 23 laboratories, where there are 5 doctors of sciences and almost 80 candidates of sciences, people are working on topics of little or, sometimes, no significance. During the last three years, the plan for contract work was fulfilled by only 68 percent, and none of the 23 proposed recommendations was an act of introducing new technology into production. Expenditures for research were 652,000 rubles, but the return was 3 kopecks per ruble of expenditure.

These deplorable results are the consequence of complacency, the absence of a responsible attitude on the part of the workers and of an exacting attitude on the part of the institute management. Groundless self-confidence and an aspiration toward imaginary independence has led essentially to a lack of agreement on its scientific subject matter with the USSR Ministry of the Chemical Industry, the "Soyuzkhimvolokno" production association, and other basic scientific institutions of the sector.

Hence, there is petty subject matter, duplication, and an absence of developmental innovations. There is no way to describe as anything but waste the fact that a whole group of institute associates who have not participated at all in scientific-research activities receive salary increases. They do not forget prizes here either.

The UzSSR Committee of People's Control, having exposed these violations recently, sternly penalized the institute managers. It must be supposed that this will also serve as a serious lesson for certain other scientific institutions of the republic that do not at present justify their high mission as champions of scientific-technical progress.

Analysis of the activities of the Institute of Cotton Cellulose Chemistry and Technology, the electronics and physical-technical institutes of the academy and, especially, the Central Asian Scientific-Research Institute of Forestry which, over the last ten years, has continued to waste over a million rubles without providing a kopeck in return, indicates that weak relevancy to life, to practice, and to the urgent needs of production remains the most vulnerable link in the chain from idea to introduction into production.

And, as a consequence, there often appear developments that lack promise, that are not needed by anyone, and often lack sufficient technical-economic substantiation.

Comrade L. I. Brezhnev points out that the introduction of a scientific concept is no less important than its development. Meanwhile, many institutions of science do not bother themselves with concern about carrying their completed projects forward to the logical end -- introduction into practice. Of course, it is not a matter without troubles, the more so because sometimes it is met with open or concealed opposition on the part of outside producers. We have reactionaries who have not been converted, who, in pursuit of momentary material advantage, do not wish to risk and try in every way possible to delay the introduction of new techniques and progressive technology. But time does not wait. In this century of scientific-technical revolution, every innovation rapidly becomes outdated and tomorrow it will not provide the same effect that it can bring today.

Undoubtedly, success in creative cooperation between science and practice depends on the mutual interests of the parties. But if a practical worker displays sloth, it is the sacred duty of scientists to display persistence in implementing their ideas. This is the fruit of their searching and hard work, their brainchild, the fate of which cannot help but concern them.

This thought was expressed very precisely by the president of the Ukrainian Academy of Sciences, Academician B. Ye. Paton, in an article published in PRAVDA. He declared that the term "introduction of new technology" itself has origins of force and compulsion. To introduce means to penetrate into the depths and this, as is known, is always done with much labor. To introduce the achievements of science into production means to deal with certain difficulties, perhaps overcoming someone's opposition, to achieve implementation of a new technical idea or the application of new machines or mechanisms.

We have examples in our republic of this kind of vital interest on the part of scientists in the embodiment of their developments in reality. One can name, in particular, the Institute of Geology and Prospecting for Petroleum and Gas Deposits of the UzSSR Ministry of Geology (IGRNIGM). The collective of scientists of this institute has been the originator of the initiative "Not One Scientific Development Without a Plan for Introduction and Utilization," and is successfully fulfilling the adopted obligation. The absolute majority of the institute's developments are introduced into production in a timely way, and the return for each ruble of expenditure exceeds eight rubles.

This is achieved by skillful and well thought-out planning for scientific research. The plan includes only topics that flow from the specific needs of the geological prospecting services of the republic, followed by obligatory confirmation by higher-level organizations and automatically are included in the plans of production organizations for introduction of new technology.

The initiative of IGRNIGM scientists has been approved by the Republic Council for Assistance to Scientific-Technical Progress under the Uzbekistan Communist Party Central Committee and has been recommended for dissemination to other scientific-research organizations of the republic. Today, it has been praised not only by us in the republic: representatives of many scientific institutes of the country are coming to Tashkent to study this experience.

In Uzbekistan we also have other effective forms of relationship between science and practice. These are scientific-production associations, complexes, laboratories oriented toward economic sectors, the conclusion of direct long-term contracts for creative cooperation between enterprises and scientific and planning-design institutions.

In recent years, the efforts of many scientific and production collectives have been concentrated and coordinated rather successfully within the framework of complex special-purpose programs directed toward the solution of large economic problems.

Approval is deserved for the organization for the first time in the republic of an educational-scientific-production complex composed of the Tashkent Textile Combine and the capital's institute of textile and light industry. This "cluster," organizationally formalized, permits fuller utilization of VUZ-science potential and, at the same time, facilitates a deepening of the educational process and a significant improvement in the quality of highly qualified specialist training.

The task consists of widely disseminating needed and useful experiences in improving the integration of science and production.

Wide new horizons for the substantial strengthening of the effectiveness of science and its ties with practice have been opened up by the decree of the CPSU Central Committee and USSR Council of Ministers "On Improving the Planning and Strengthening the Influence of the Economic Mechanism on Improving the Effectiveness of Production and Work Quality." All of this important document is permeated with concern for accelerating the implementation of scientific discoveries and raising the technical level of the country's economy.

Of paramount importance in planning at all levels is the fullest utilization possible of scientific-technical potential. An important place in the plans of ministries and agencies, according to this decree, is now occupied by programs for the solution of scientific-problems of economic sectors, for the complex utilization of natural resources, for measures to create, assimilate, and introduce new techniques and technology.

Among other measures that will undoubtedly aid the acceleration of scientific-technical progress are the transfer of ministerial institutes, planning-design organizations, and scientific-production associations to the cost-accounting system, the creation in ministries and agencies of a unified fund for the development of science and technology to finance projects and replace expenditures related to the development and assimilation of new types of products and technological processes, and a new system of rewarding successful fulfillment of projects for new technology and re-tooling of production.

A large amount of work is now being done in our republic to implement all of the measures provided for by the party and government. Perhaps we are not as successful as we would like to be. It is evident that a number of republic ministries, particularly the light and cotton-cleaning industries, are not rushing to create a unified fund for the development of science and technology. In some places, ministerial scientific institutions and planning-design organizations have still not gone to full cost accounting, and the utilization of bank credit to finance commission-orders according to contracts is still not practiced.

It must be kept in mind, however, that the restructuring of the whole economic mechanism, an integral part of which is scientific potential, is a complicated matter that requires careful preparation. Only it is important not to delay it and not to keep putting it off. The sooner and more successfully we will be able to implement the measures planned by the party and government for the intensification of scientific research, for increasing the return from science, and for strengthening the union of creative thought and creative labor, the more rapidly we will approach that day in the future and the more successfully we will accomplish the great tasks of building communism.

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NEW REPUBLIC COUNCIL FOR SCIENTIFIC AFFAIRS IN UZBEK SSR

Tashkent EKONOMIKA I ZHIZN' in Russian No 12, Dec 81 p 32

[Text] The Republic Council for the Coordination of Scientific Research Projects in the Uzbek SSR has been created with the aims of improving coordination, improving the timeliness and effectiveness of scientific-research projects, and accelerating the introduction of scientific and technical achievements into the economy.

A. S. Sadykov, president of the UzSSR Academy of Sciences, has been designated the chairman.

From UzSSR Gosplan, I. V. Chirgadze, the deputy chairman of UzSSR Gosplan, and V. A. Khodzhimatov, the chief of the administration for science and technology, have been made members of the Council.

The Council includes important scientists, party and Soviet workers, managers from ministries and agencies, scientific-research institutions, VUZ's, and production associations.

The Council has been entrusted with the obligation for organizing analysis of the status of fundamental and applied sciences and for determining prospects for their development in the republic, the coordination and agreement of plans of all scientific-research projects, the development of problems for complex research programs and control over their fulfillment, the development and introduction of proposals for the utilization of research results and control over their implementation, and other work.

The Council has been given the right to obtain from ministries, agencies, scientific-research institutions, and VUZ's all data and materials on scientific-research projects, to hear reports on the status of research, to evaluate their results, and to make appropriate recommendations on this and other questions relative to improving the effectiveness of scientific-research projects and to the acceleration of the introduction of scientific-technical achievements into the economy.

The Council's decisions are mandatory for all ministries and agencies of the UzSSR, scientific-research institutes and VUZ's of the republic.

Plans for the Council's work and reports on its activities are annually submitted to the UzSSR Council of Ministers.

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UKRAINE SLOW IN ADOPTING NEW S&T INTO ECONOMY

Kiev PRAVDA UKRAINY in Russian 27 Jan 82 p 3

[Article by the PRAVDA UKRAINY Investigating Team: G. Gorelov, engineer and member of the scientific council of the scientific-technical society of the Southern Pipe Plant; Yu. Dedov, engineer of the ferroalloy plant; V. Trubnikova, senior engineer-economist of the construction-materials plant; I. Derkach, engineer-technologist of the city milk plant and scientific secretary of the council of scientific-technical societies of the Ukrainian Communist Party gorkom; and N. But, section chief at the editorial offices of the newspaper NIKOPOL'SKAYA PRAVDA and a member of the city review commission -- Dnepropetrovskaya Oblast: "On the Road to Innovation"]

> [Text] The preparation in Nikopol' for the republic review of the introduction of scientific and technical achievements into production began to expand at the beginning of last December. To a significant degree this was furthered by the activization of the council of scientific-technical societies under the Ukrainian Communist Party gorkom. Examining the immediate tasks in light of the demands of the November (1981) plenum of the CPSU Central Committee, the presidium of the council decided to develop a city complex special-purpose program, "The Economy of Resources for the Five-Year Plan," which represents a collection of scientific-technical measures for the economical utilization of labor and material resources provided for by complex and individual creative plans of society members.

In December, the presidium of the council of scientific-technical societies under the party gorkom summed up the creative competition of specialists. Seven of them, who fulfilled individual plans for the introduction of scientific-technical achievements ahead of time, were awarded prizes. Among those noted was V. A. Tarasenko, a member of the scientific-technical society for ferrous metallurgy and the chief of the chemical engineering laboratory of the Southern Pipe Plant.

Our investigating team was interested in the results obtained by pipemakers in introducing scientific and technical achievements into production under the 10th Five-Year Plan and in the first year of the 11th Five-Year Plan. Specialists from the plant maintain relationships with almost twenty ministerial, academy, and educational institutes. In the past five-year plan, there were introduced, as planned, 248 scientific developments, with an economic effect of almost 25 million rubles.

In addition, the engineering services helped plant experts introduce 11,000 rationalizers' proposals and 64 inventions with an economic effect of over 20 million rubles.

The investigation has shown that last year, of 27 planned developments, 24 were implemented. New technology for thermal hardening of underground pipe, proposed by scientific associates of the Dnepropetrovsk Metallurgical Institute, did not find application at the pipe-rolling plant No. 2. The economic effect from improving pipe quality was assumed to be 112,000 rubles.

"The plant services are at fault for the lack of timely utilization of the innovation," said N. I. Tregubenko, the chief of a group of the technical department of the enterprise. "The reasons for this will be analyzed by the review commission, then an appropriate presentation will be made by the factory management."

Broad application of new technology for the manufacture of tools is being delayed for objective reasons. For three years, workers from the Institute of Electric Welding imeni Ye. O. Paton of the UkSSR Academy of Sciences, in cooperation with plant specialists, carried on research that showed the high effectiveness of electroslag remelting of used pipe tools instead of forging. The materials and labor are being reduced in the manufacture of technological tools.

"New technology permits practically avoiding the production of metal for manufacturing gauges. The yearly saving is about a thousand tons," said the head of the laboratory, P. D. Mavrodiy.

What he said was supplemented by the deputy director of the plant's pipe tool shop, V. A. Surzhikov: "To build a section for electroslag remelting of used pipe tools, it is necessary to spend about 3 million rubles. These funds would be repaid within three years. But the question of allotting means has not been solved for some reason."

It must be assumed that the UkSSR Ministry of Ferrous Metallurgy is deeply studying this question and will help the Paton people and the Nikopol' pipemakers carry this matter forward to completion.

During the last six years, specialists from the Nikopol' Ferroalloy Plant have introduced 130 scientific developments from the Ukrainian Scientific-Research Institute for Special Steels, the Don Scientific Research Institute for Ferrous Metallurgy, and other scientific institutions with an economic effect of 2.8 million rubles. About 700,000 rubles was provided by using slurry and slag in the production of ferroalloys. This development by the Ukrainian Scientific Research Institute for Special Steels was aided by specialists from the plant, V. M. Mangatov and N. D. Chernyayev.

A significant effect should also have been achieved by the Nikopol' electrometallurgists from a system for heat crumbling of manganese concentrates (a development of the Don Scientific-Research Institute of Ferrous Metallurgy). It was planned to be put into operation last year. However, construction was delayed through the fault of the Nikopol'stroy trust, which used only half of the planned funds. The trust management and the Dneprometallurgstroy combine must take measures to accelerate construction of the system.

In accord with recommendations by the All-Union Scientific-Research Institute for Construction Materials a complex of measures was undertaken at the Nikopol' Construction Materials Plant for the mechanization and automation of brick production. It was established by the investigation that there was a delay here in the application of recommendations by the Ukrainian Scientific Research Institute for Construction Materials for utilization of waste furnace gases for drying brick raw materials in drying rooms. The explanation for this is that the Promstroy management of the Nikopol'stroy trust delayed construction of a special conduit for these purposes. The management and specialists of the plant were to blame for the lack of timely mechanization of the unloading of brick raw materials from drying chambers.

Investigation showed that, in Nikopol', the most backward sector in introducing scientific achievements into production is construction. This question was examined at a meeting of the city review commission, which was headed by the second secretary of the gorkom, I. K. Mitchenko. The commission planned to conduct, during the period of republic review, a city scientific-production conference on the subject "Ways to Accelerate Technical Progress in Construction." Preparation for the conference essentially has been completed.

Specific measures for accelerating the introduction of scientific-technical achievements into production have been outlined by all review commissions of city enterprises. Attention should be given to the decision of the commission of the ferroalloy plant on providing specific aid to the kolkhozes of Nikopol'skiy Rayon.

Public correspondents' points of the city newspaper NIKOPOL'SKAYA PRAVDA have been created at 36 enterprises in Nikopol'; a majority of them, during the republic review, have already been engaged in investigating the fulfillment of planned measures. Materials from the investigations are being published in large-circulation newspapers and wall newspapers in the city. Information on the measures taken is being published regularly.

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UKRAINE ECONOMY ADOPTING NEW TECHNOLOGY

Kiev PRAVDA UKRAINY in Russian 13 Jan 82 p 1

[Interview of Kiev gorkom party secretary, D. B. Golovko, by a correspondent from the Radiotelegraph Agency of the Ukraine: "According to the Reference Points of the Five-Year Plan"; date and place not given]

> [Text] The review of the introduction of scientific achievements into the economy continues to expand more widely in the republic. Participation in it by the scientists and producers of the Ukrainian capital is discussed by the secretary of the Kiev party gorkom, D. B. Golovko, with a correspondent from the Radiotelegraph Agency of the Ukraine.

[Golovko] The aim of the review is well expressed by the motto "The Union of Creative Thought and Creative Labor for Accelerated Creation and Introduction of New Engineering and Technology." In other words, with broad participation of scientists, specialists, and innovators of production, we need to sum up the results achieved during the first year of the five-year plan, carefully evaluating the technical status of each worker's job, section, or shop from the point of view of their being equipped with mechanization and automation hardware, possibilities for applying the latest technological processes, robots, and manipulators, and to verify how effective and reliable the mechanism is that has developed in the city for managing scientific-technical progress, and to determine the factors that stimulate effective introduction of scientific achievements into production, and to assess the quality of plans for new technology and the effects from its utilization. And, of course, we need to analyze thoroughly the subject matter of scientific research and its success rate and to weigh the effectiveness of confirmed forms of cooperation between scientists and producers in the solution of key economic problems.

A certain system has evolved in the city for supporting scientific-technical progress. Appropriate commissions of the party gorkom continue to grow. Educational-scientific-production associations, which include VUZ's, research institutes, and enterprises, have been created. More than 300 enterprises of 56 union and republic ministries and agencies have participated in implementing special-purpose scientific-technical programs. That is why the participation of the maximum number of production and scientific collectives is provided for in the review.

[Question] How is the review program being implemented?

[Golovko] It is being conducted in three stages -- at enterprises and organizations, then on the rayon scale and, finally, on the city scale. In the review program are seminars, scientific-technical creative competitions, exhibits of the best projects in research institutes and VUZ's, and showings of scientific-popularization films at enterprises . In the lecture bureaus "Rostrum of the UkSSR Academy of Sciences," "Science for Production," and "Young People Concerned with Scientific-Technical Progress," leading scientists talk about the latest developments that are important for the progress of different economic sectors. A whole day of political informational activity is taking place on the topic "Increase the Rates of Scientific-Technical Progress and Strengthen the Ties Between Science and Production." Trade union and komsomol organizations have been widely enlisted in the conduct of the review.

At enterprises and scientific institutions of the city, review commissions have been created to analyze progress in fulfillment of agreements for creative cooperation, the quality of plans for new technology, the status of scientific-technical creations and rationalizers' and inventors' works. We attach great importance to obligatory discussions of performed work at meetings of collectives and at expanded sessions of party and trade union committees. Party and administrative leaders of the city are discussing the most significant questions relating to scientific-technical progress and new proposals and undertakings.

An important part of the review consists of the popularization of the experience of those enterprises and scientific institutions that, having combined efforts to solve urgent problems, have already achieved worthwhile results. Examples are the "Tochelektropribor" plant and the Institute of Electrodynamics of the UkSSR Academy of Sciences, whose joint work in creating instruments for ultra-accurate measurements has been awarded USSR State Prizes. Republic state prizes have been registered by producers at the "Bol'shevik" plant and scientists of the Institute of Electric Welding imeni Ye. O. Paton of the UkSSR Academy of Sciences, who have created a shop at the plant for electroslag remelting, and also by specialists from the plant imeni Lepse of the "Kiyevtraktorodetal'" association and associates of the Institute of Casting Problems of the UkSSR Academy of Sciences, who developed and implemented new technology for the production of tractor components, using measured metal flow with the aid of magnetodynamic pumps. The successful cooperation of these collectives has largely enabled the development of the complex scientific-technical programs being implemented today.

[Question] Please describe their substance, at least briefly.

[Golovko] Each such program, stressed Comrade L. I. Brezhnev, should represent a plan of action substantiated by precise estimates, directed toward an end result and toward complete solution of a problem. We have been guided by this policy in determining the chief points for applying scientists' and producers' joint efforts. The reference points of the 11th Five-Year Plan have been taken as the basis.

A very urgent task for us is to achieve growth in the volume of industrial production without increasing the number of workers, that is, by raising labor productivity. Therefore, one of the six special-purpose programs is directed toward reducing manual operations at enterprises, in transportation, and in construction organizations. Provided for, in particular, is the start-up of 18 complex mechanized plants, 88 shops, and 608 sections. This will permit the transfer from manual to mechanized labor of about 30,000 people, including all women, and the improvement in work conditions for another 15,000 laborers.

In the "Kiyevmetall" program it is planned to create model indicators from the point of view of economical utilization of metal by shops and sections and wide application of reduced-waste production of machines and structures and the introduction of powder metallurgy in component manufacture. This will allow a saving of over 3000 tons of metal.

Other programs cover such problems as economical expenditure of energy and materials, automation, increase in the effectiveness of construction, environmental protection, fuller utilization of agricultural raw materials, and improved means for product storage.

Implementation of programs is managed by coordination councils headed by D. A. Dudko, academician of the UkSSR Academy of Sciences; N. V. Novikov and Yu. A. Vetrov, corresponding members of the UkSSR Academy of Sciences; Ye. M. Luk'yanova, corresponding member of the USSR Academy of Medical Sciences; and other well-known scientists.

During the present five-year plan, over 250 inventions will be introduced into the economy. For this, a kind of directory has been prepared, cataloguing necessary developments oriented toward the needs of enterprises and significant for all industry. For their accelerated implementation in industry, an agreement has been concluded between the party gorkom and the UkSSR Academy of Sciences for scientific-technical cooperation, and contacts are being strengthened between scientists and practical workers. For, as stressed at the 26th CPSU Congress of the Ukrainian Communist Party by V. V. Shcherbitskiy, member of the Politburo of the CPSU Central Committee and first secretary of the Ukrainian Communist Party Central Committee, by just working out an appropriate mechanism for science-production relations, it is possible to reduce the time taken for implementing a scientific idea -- from its origin to serial output of new types of products.

[Question] Do you have data to illustrate the effectiveness of cooperation between scientists and producers?

[Golovko] City industry, ahead of time, on 28 December, fulfilled the plan for realizing products and output of the most important types of items. Almost 72 million rubles' worth of products were realized above plan. Labor productivity rose by 3.9 percent, although the planned increase was 2.9. The volume of products of the highest-quality category increased. There were commissioned 1.225 million square meters of housing. In short, Kievans confidently began the five-year plan and entered the 60th year since the formation of the USSR and the city's 1500th year in a good frame of mind. These successes, undoubtedly, have involved both scientists and all who, having united efforts, are doing much for the acceleration of scientific-technical progress.

In the course of the review, determining the best and exposing the backward, generalizing and disseminating the experience of the front-rank, analyzing the reasons for neglect, we will direct our efforts toward the intensification of production and increase in its effectiveness. It is toward this that the decisions of the 26th CPSU Congress are directed.

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PRODUCTION TIES WITH SCIENTIFIC INSTITUTIONS TO BE INTENSIFIED

Minsk KOMMUNIST BELORUSSII in Russian No 1, Jan 82 pp 71-76

[Comments by Professor I. Leonovich, deputy BSSR minister of higher and secondary specialized education and a doctor of engineering sciences, Yu. Bolotov, director of the Minsk Planning-Design Technological Institute and a candidate of engineering sciences, and P. Yashcheritsyn, academician secretary of the Department of Physical-Technical Sciences of the BSSR Academy of Sciences, on materials from a meeting arranged by the editors of KOMMUNIST BELORUSSII at the association "Minsk Tractor Plant imeni V. I. Lenin: "The Integration of Science and Production: To Strengthen Relationships Between Them and to Search for New Forms for Them"]

> [Text] Under this heading, the journal KOMMUNIST BELORUSSII No 10 for 1981 published material from a "round table" discussion organized by the editors at the Minsk Tractor Plant imeni V. I. Lenin. In the material was talk about the problems of improving the relationship between production and scientific institutions in the interests of improving agricultural technology, and there were a number of critical notes and proposals. At the request of the editors, scientists also stated their opinions on the questions touched upon.

COMPLEX SOLUTIONS NEEDED

"The tractor builders have raised important and timely questions," declared Professor I. Leonovich, deputy BSSR minister of higher and secondary specialized education and a doctor of engineering sciences, in a conversation with a journal correspondent. The opinions and proposals of the specialists from the Minsk Tractor Plant were discussed, among other problems, at a meeting of the prorectors from a number of VUZ's of our ministry. The following are the brief conclusions that are to be made both from the material published by the journal and from the discussion of it."

The tractor builders are right in maintaining that the system of educational-scientific-production associations has lowered their effectiveness to a certain degree. From this, we must make serious conclusions. Certainly, we do not have to make cardinal changes in the form that has evolved for interaction between VUZ's and production, but it is necessary to make certain that strenuous and fruitful work is provided for within the system.

Now, when we are participants in the creation of scientific-technical prospects, it is necessary to enter more deeply into the substance of planning science and production, the training of specialists, the creation of educational literature, and so forth. In other words, on the basis of strengthening interaction, VUZ science and production can and must move from external, largely formal, contacts, to strong, organic ties.

A few words about what can be done to accomplish the tasks mentioned above. First, the preconditions have now come about for differentiating certain processes in our interaction, particularly for transplanting a number of research subjects and specialist training centers. For example, research laboratories oriented toward economic sectors are most often located at educational institutes. It seems that it is more rational to have them directly at plants. Moreover, at the present stage, it is already possible also to move part of the strictly institute laboratories to plants and to create experimental sectors, test areas, and even shops there. On the one hand, this would help bring VUZ scientists and students closer to production and to its needs. On the other hand, it would open the way to still more active enlistment of specialists from the economy in our investigations and research and to improvement in the creative component of their work. We have good examples of such interaction. Thus, Professor D. Khudokormov of the Belorussian Polytechnical Institute, a doctor of technical sciences, and specialists of the department headed by him have for a long time made themselves at home at Minsk factories. And for one of their significant projects -- for secondary utilization of waste from aluminum alloys -- the scientists, together with the producers, were awarded the BSSR State Prize.

Secondly, for certain, it is necessary to examine the composition of our associations and reject those that are lacking in results, have no prospects, or exist only formalistically. And, on the other hand, we must develop those where projects can open up broad and realistic preconditions for more significant cooperation. In particular, this seems to be possible in the case of the association between the Gomel' Polytechnical Institute and "Gomsel'mash."

Thirdly, in our opinion, the time has come for a transition to the formation of complex scientific-organizational structures. Let us say that the Minsk Tractor Plant has created associations simultaneously with the Belorussian Polytechnical Institute, with the Belorussian Institute for the Mechanization of Agriculture, and with the BSSR Academy of Sciences. Would this be rational? Would we not get into one another's way? The answer to the question most likely lies in the creation of a general problem association with unified long-range planning, coordination of efforts, and rational division of labor, so that all aspects of production are covered more fully and without duplication: design, technological, economic, social, personnel, and so forth.

Fourthly, it would be advisable to think through the alternatives for interaction at a higher level: the Ministry of Higher and Secondary Specialized Education with an economic ministry (agency). True, the forms for such cooperation still have to be determined, but one of them could be the creation of joint technical-economic councils. There is also a specific proposal. In the republic, on the one hand, there are four construction ministries, plus BSSR Interkolkhoz Construction Organization, and BSSR Gosstroy with all their institutes and, on the other hand, the Ministry of Higher and Secondary Specialized Education and its institutions. Here is a real basis for creating a problem association or countil that could coordinate the accomplishment of a complex of interrelated scientific-technical tasks: for example, to determine the theoretical bases of heat balance within buildings and facilities, to develop new heat-saving designs and the industrial technology for their manufacture, to translate the solutions into designs and, finally, to implement them in practice.

It would seem that it would also be possible to find other forms for interaction that would facilitate the successful accomplishment of the task, posed at the November (1981) plenum of the CPSU Central Committee, of more effective utilization of accumulated scientific-technical potential.

TIMELY AND URGENTLY

"The proposals made by leading specialists of the association 'Minsk Tractor Plant imeni V. I. Lenin' for further improvement and development of regional management of science are extremely topical," reported the director of the Minsk Planning-Design Technological Institute and candidate of engineering sciences, Yu. Bolotov. "This form of coordination is the most effective. It helps orient workers of science toward fulfilling specific tasks and large problems the solution of which is beyond the capabilities of enterprise specialists. In this connection, the lengths of time for conducting developments are being reduced, the quality of research is being improved, the introduction of research results into production is being accelerated, and the economic effect is growing.

This is especially important for institutes of an applied character such as ours, since with work under the new conditions for planning and financing projects on new technology, the advantages mentioned above guarantee us the creation of funds for economic incentives which, in many cases, an institute lacks if it carries out various developments according to requisitions from economic ministries.

A few words about what happens at present when regional management is essentially absent. Being the head technological organization for the All-Union Industrial Association "Soyuztraktorozapchast'," our institute, in accord with the plan for the economic sector, annually works with 60 to 70 requisitioners situated throughout the country. This severely complicates our work and has a negative influence on the results of the operation. It is sufficient to say that we spend 70,000 to 80,000 rubles yearly on travel. Under regional management these expenditures could be significantly reduced.

Regional management of science would allow significantly more efficient solution also of the problems of supply and equipment support to developments. Thus, the ministry allots us usually 1/3 to 1/2 of the steel and nonferrous metal and 1/14 to 1/13 of the cast iron required to manufacture the equipment, fittings, and means for mechanization and automation of technological processes provided for by the plan. Our supplies of other types of raw materials and materials are about the same, if not worse.

I will not dwell on how we can get out of this position. I will say only that if we were not close to industrial enterprises of the region and other enterprises in Minsk and in the republic did not help us, we could hardly fulfill the plan for science and technology every year. Sometimes, we have to order castings from Khar'kov, anneal it in Baranovichi, chisel it out in Minsk, and send the finished product to Rovno.

Under regional management of science, such problems would be solved efficiently, because there would not only be direct motivation by the requisitioner to shorten the periods of development and accelerate its introduction into production, but also the possibility to assist this process actively. Cooperation with the Minsk Gear Plant convinces one of this. Our interaction has the character of true integration, when each does just what is rational for the accomplishment of the total task. But we could also work together with other enterprises of the city and of the republic; however, we do not have any basis for this, formally.

These are only individual, basically technical, aspects of the question that support the advisability of improving the system of regional management of science.

The regional location of the institute itself to a certain degree obligates its collective to cooperate with enterprises of a given region independently of its agency subordination. Meanwhile, the volume of joint work with enterprises of Partizanskiy Rayon of the Belorussian capital -- the city of Minsk and the republic as a whole -- is not large. True, each year it increases but, in 1981, it was only 13.5 percent of the work fulfilled by us. In addition, only about half of this amount goes into the subject plan of the institute and is financed by the ministry. The remainder is so-called self-initiated subject matter fulfilled on the basis of direct contracts. Further expansion in cooperation with Belorussian industry is hampered by internal agency barriers which are difficult to overcome: the labor and wage fund limits are determined for the institute by the All-Union Production Association "Soyuztraktorozapchast'" and it does this, it seems, with only its own interests in mind.

In our opinion, the Minsk party gorkom could provide real assistance in the development of more rational relations between science and production. Just within Partizanskiy Rayon of Minsk are located three large plants -- tractor, motor, and gear plants -- and our institute, which are all subordinate to the same USSR Ministry of Tractor and Agricultural Machine Building. And it is completely unnatural that we can cooperate with one of the plants on a legal basis but, with the two others, we are forced to arrange only episodic contacts.

The activities of enterprises in one region that are close in subject matter to developments at scientific-research institutes and design bureaus, in our opinion, should be tied together with a city plan for the coordination of scientific-research and planning-design work. Such plans should provide for the participation of scientific organizations in the solution of any problem in the city, should predetermine preliminary figures for the year, and should direct requests to appropriate ministries to include listed projects in the subject plans of institutes and to provide financing for developments. Such a management form will aid the expansion of regional relationships between science and production and the acceleration of introduction of developments into production.

THE PROCESS CAN BE ACCELERATED

"Materials from the 'round-table' discussion published in this journal were discussed at a meeting of the bureau of the Department of Physical-Technical Sciences of the BSSR Academy of Sciences," reported the academician secretary of the department, P. Yashcheritsyn. "Scientists of our academy believe that the tractor builders have raised a number of problems relative to cooperation between science and production. Actually, reality requires improved forms for our interaction. The presidium of the BSSR Academy of Sciences, the Department of Physical-Technical Sciences, and its institutions are now directing efforts toward this end. Measures will be taken that will be directed toward expanding and strengthening the relationships between academy institutes and the Minsk Tractor Plant and toward providing more effective assistance in assimilating new techniques and technology.

However, according to P. Yashcheritsyn, the discussions that took place at the plant did not touch on many questions relating to the acceleration of scientific-technical progress in machine building. The accomplishment of this task is often constrained when producers wait in line for solutions to urgent problems that arise in the course of production. And academy science at times is not able to respond effectively to such needs. Evidently, its interaction with production should be built on some other basis.

From the point of view of academy scientists, the union of science and production should be based on forecasts in the development of some field of machine building. The main directions of this development were pointed out in the decisions of the 26th CPSU Congress, but specific prospects for a factory should be determined by both the economic ministries and enterprises themselves. As for scientists of the BSSR Academy of Sciences, with consideration for the specific prospects, they will be able to plan research in conceptually new fields that can actually revolutionize production.

Meanwhile, practice has evolved whereby initiative in promoting innovations is often taken on by the Academy of Sciences itself, and this is often far from being justified. Production should be more persistent in beating a path to science. For this, it would be useful if, in the process of preparing the regular annual plan, producers and specialists from ministerial scientific-research institutes would come to academy institutes to become acquainted with finished developments and to estimate what could and should be included in plans for new technology and then implemented in the shop. This is still not the case, and an extremely insignificant share of the unified funds created within economic sectors for the development of science and technology are used for the introduction of the results of academy scientists' research. In other words, interaction is lacking an official, planned basis which, of course, cannot fully be replaced by plans for mutual cooperation built largely, so to speak, on nongovernmental foundations.

Another minus in the interaction of production and academy science is that enterprises sometimes expect from scientists solutions not only in principle, but in finished equipment. Perhaps, in time, there will be a number of interministerial plants as discussed at the 19th plenum of the Communist Party (Bolshevik) Central Committee; this would be more realistic. It is still no secret that the technical capabilities of the BSSR Academy of Sciences and its institutes is lower than those at large plants. Consequently, plant services for mechanization and automation, design departments, shops, and sections for manufacturing nonstandard equipment must be plugged into the creation of new technology and equipment for new technological processes. For example, at the Institute for Heat and Mass Transfer of the BSSR Academy of Sciences, conceptually new methods have been developed for heat-treatment processes that can be widely applied in machine building. At the same time, it is clear that the institute itself, without active assistance from plants, will not be able to provide for broad dissemination of the innovation.

In large measure, the problem of possibly wider application of progressive developments could and should be aided by a mass organization such as the scientific-technical society of the machine-building industry, a society that just in our republic unites thousands of highly qualified specialists. Who better to find ways to apply promising scientific developments under the specific conditions of a plant? However, the society has still not become a full-fledged link in the science-production chain.

I think that our overall, long-standing mistake," continued P. Yashcheritsyn, "is that for many years the fundamental efforts in science-production cooperation was directed toward the improvement of machine design, but technology remained in the dark. The time has come to correct this "misalignment" and, with joint efforts, eliminate backwardness in technology and direct efforts precisely toward improvement in this important sphere of contemporary production.

The well-known physicist, Max Born, laconically and very much to the point, noted: "The business of science is to comprehend what is new; the business of technology is to create what is new." And, if the subject is the integration of science and production, it does not at all mean the erosion of the boundaries or the confusion of the functions of the two parties. Moreover, cooperation will become rational only when both parties, operating according to a single program, do precisely that which each of them is capable of doing to a larger degree.

Not long ago, the BSSR Academy of Sciences took a new step on this route. A group of qualified specialists and managers from scientific institutions visited Gomel'. They were received by the first secretary of the Gomel' obkom of the Belorussian Communist Party, Yu. Khusainov; then the scientists became familiar with "Gomsel'-mash" and, together with the producers, brought out those important problems in the development of techniques and technology of production that need assistance from science. Now, a program of joint actions is being drafted that will be a bridge in aiding more successful cooperation; it will clearly determine the areas of work, the academy scientists, production specialists, and branches of science.

"It is also necessary," said P. Yashcheritsyn, in conclusion, "that, at large machine-building enterprises, there be created long-term groups or scientific-research centers that would be engaged in determining tomorrow's needs for techniques and technology. This would also help us to be oriented to general trends in the development of machine building and would be of use to production, since our cooperation would acquire a more solid and long-term planning basis.

Under present conditions, the words of the general-secretary of the CPSU Central Committee, Comrade L. I. Brezhnev, sound like a guide to action: "A first-priority task for us remains the acceleration of scientific-technical progress . . . Only on the basis of the accelerated development of science and technology can the tasks of the social revolution be accomplished -- and a communist society be built."

The accomplishment of this task requires still broader development of our own forms, inherent in socialism, of integrating science and production. This means, first of all, the necessity for finding and putting into operation the organizational solutions that will provide for the greatest economic effect. Secondly, in the development and implementation of these solutions, it means maximum utilization of the capabilities provided by the balanced, complex planning of our economy, the general aim of which is steady increase in the material and spiritual level of the lives of the Soviet people.

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LATVIAN ACADEMY OF SCIENCES PRESIDENT DISCUSSES ACADEMY'S WORK

Riga SOVETSKAYA LATVIYA in Russian 2 Feb 82 p 2

[Article by A. Malmeyster, president of the Latvian SSR Academy of Sciences: "Broad Horizons"]

[Text] The horizons and scope of investigations by Soviet science are broad. It occupies an advanced position in many crucial areas -- from the study of outer space to penetration into the depths of the atom. The union of the achievements of the scientific-technical revolution with the advantages of socialism is looked upon by our party as a task of very important significance.

At the 26th CPSU Congress, it was stressed that the close integration of science is a persistent requirement of the present epoch. The 11th Five-Year Plan was a step toward fulfillment of this task. All through the plan runs the theme of the organic relationship between material production sectors and advanced science.

Latvian scientists are making a tangible contribution to this along with the scientists of all the brother republics. In recent years, we have utilized more effective forms for integrating science and economic practice. Institutions of the Latvian SSR Academy of Sciences, which was created with the active participation of the USSR Academy of Sciences and of scientists of brother republics, successfully fulfilled the planned tasks of the 10th Five-Year Plan. On the basis of finished fundamental and applied research, 367 proposals for urgent production problems were developed and introduced into various sectors of the economy. This was made possible by contracts concluded by academy institutes with various enterprises and organizations. During the five-year plan, the volume of contract work grew significantly and, by 1980, equalled 22.2 million rubles. In addition, for developments at the institutes, 14 agreements with foreign companies were concluded. Licenses were sold for medicinal preparations, technology for microbiological synthesis of livestock feed and other products, and for effective technological processes. For original engineering and technological solutions, 801 authors' certificates and 299 foreign patents have been obtained.

The results of applied research have been displayed at many national and international exhibits. The best of these were awarded 18 gold, 39 silver, and 128 bronze medals. For outstanding achievements under the 10th Five-Year Plan in science and technology, scientists of the academy were awarded 3 USSR State Prizes and 16 Latvian SSR State Prizes.

Utilizing the results achieved under the past five-year plan, the collective of the Latvian SSR Academy of Sciences is now continuing to expand and deepen both fundamental theoretical research and engineering and technological developments for their subsequent use in production. Developments by scientists in a number of areas are having a significant influence on the development of various economic sectors throughout our country.

The Latvian SSR Academy of Sciences is a co-performer on 31 all-union special-purpose complex and scientific-technical programs. I will touch on only individual areas. Thus, our academy is taking part in developing the republic food program, and research in this area is conducted by 7 institutes. Accomplishment of the food program is closely related to radical improvement in feed production and to satisfying the needs of livestock raising for feed and the creation of a dependable and balanced feed base.

Scientists of the Institute of Microbiology imeni Avgust Kirkhenshteyn are successfully working on this problem. On the basis of deep fundamental research in microbic biosynthesis of amino acids, protein substances, and enzymes, biotechnologies are being created for producing valuable feed additives from wastes or by-products from agricultural and food production. The technology created at the Institute of Microbiology for producing lysine -- a highly effective means for enriching low-protein rations for agricultural animals -- has been the basis for constructing the Livani Experimental Biochemical Plant. In all, in the country, only five plants turn out 8000 tons of this feed concentrate.

It has now been shown practically that each ton of lysine under the conditions of our country will provide over 50,000 rubles of economy.

At the present time, microbiologists are faced with the task of producing enriched feed products from green plant mass or low value raw materials such as straw by using the methods of chemical, microbiological, and biological technology.

An example of the high intensity of the scientific research and active utilization of its results are the creation of new medicinal means for treating serious diseases and the introduction of effective preparations into health practice. The appropriate institutes of the academy are giving special attention to the synthesis of new medicinal forms and to the creation of new equipment for diagnosis and prophylaxis of diseases.

One of the scientific centers of the USSR that has already been working successfully for 20 years in this area is the Institute of Organic Synthesis of the Latvian SSR Academy of Sciences -- a large scientific institution, widely known in our country and abroad. Just during the last five-year plan, the Institute of Organic Synthesis created 19 new medicinal preparations for the treatment of oncological, cardiovascular, and neuropsychic diseases and viral and bacterial infections. This institute has created 32 medicines that are used in medical practice including the antiedemic preparation fluorofur, carbocronen for treating cardiological patients, the antiviral preparation remantadine, the antileukosis preparation asparaginase, and others.

Increasing significance is being acquired in the economy by the application of polymers, without which it is difficult to imagine further development in such fields as transport machine building and construction. Polymers are increasingly being applied as anticorrosive coverings, as replacements for natural fibers, and so forth. The collective of the Institute of Polymer Mechanics is engaged with the problems of creating new polymer materials and manufactured items. Here also is developing a new area in the mechanics of solids and polymers -- biomechanics. The results of biomechanical research are being introduced successfully in surgical practice.

With the creation of manufactured items and structures of such materials, the necessity arises for determining their physical-mechanical properties without destruction. To solve these problems on the basis of theoretical research, the Institute of Polymer Mechanics has created methods for the diagnosis and prognosis of such materials. To implement the methodology, over 50 types of instruments and sensors have been developed that permit the determination of materials in manufactured items directly. The application of the whole complex of the cited developments in the economy will provide a large economic effect.

The decisions of the 26th CPSU Congress pose the task of increasing the production of new materials, coverings, and manufactured items based on metallic powder, powder alloys, and refractory compounds. The Institute of Inorganic Chemistry of the republic Academy of Sciences is working in this area, conducting fundamental research in plasma chemistry and plasma technology. Owing to the many-year search, specialists in inorganic chemistry have created technology for plasma-chemical synthesis of nitrides, carbides, and borides, and their composition in the form of dispersed powders of high purity. These compounds possess valuable and, in a number of instances, unique, physical-mechanical properties -- increased impact-ductibility, hardness, thermal conductivity, and resistance to corrosion and radiation. Such materials are finding wide application in various sectors of industry. One of the first practical applications of the new materials is in producing superhard metal-cutting tools with increased impact ductility. Superhard tools are now used by more than 80 plants in the country. Applications of plasma technology are also planned for restoring components in agricultural technology, roadbuilding and construction machines, and equipment in the textile industry. Plasma technology is also promising in fighting metal corrosion. The special design bureau for inorganic materials of this institute is already putting out small batches of a new material; however, under this five-year plan, the creation of a separate branch of industry is imminent.

Acceleration in the rates of scientific-technical progress is truly a national problem. The scientists of our republic, putting into practice the decisions of the 26th CPSU Congress and the November (1981) plenum of the CPSU Central Committee, are working in close contact with the USSR Academy of Sciences and academies of sciences of the union republics, with whom we are bound by close and fruitful creative friendship, and much is being done for further improvement in the effectiveness of scientific research and for its most rapid possible introduction into production.

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LATVIAN ACADEMY OF SCIENCES RESEARCH INVOLVED WITH FOOD SUPPLY

Riga SOVETSKAYA LATVIYA in Russian 23 Jan 82 p 2

[Article by M. Beker, academician of the Latvian SSR Academy of Sciences: "Scientists for the Food Program"]

[Text] "The food problem -- both on an administrative and a political plane -- is a central problem for the whole five-year plan," noted Comrade L. I. Brezhnev at the November (1981) plenum of the CPSU Central Committee. The exceptional importance of the task of meeting the country's food requirements was stressed. In this complicated matter, as was noted at the plenum of the CPSU Central Committee, it is necessary to utilize local resources more fully.

The scientists of Latvia are participating widely in this work. Their purposeful research and experimental-design work should become a pledge for successful fulfillment of one of the subprograms, "Science for the Food Program." Institutes of the republic Ministry of Agriculture are becoming chief performers in this area. Considerable significance is being allotted to the introduction of the latest developments that have originated in institutes of the Latvian SSR Academy of Sciences and republic VUZ's.

Experimental plants for the production of new feeds are being created according to developments by the Institute of Wood Chemistry and the Institute of Microbiology imeni Avgust Kirkhenshteyn within the framework of the food program. In Valmiyerskiy Rayon, construction of the "Zilayskalns" plant for making molasses and feed yeast from poorly decomposed peat. At the "Uzvara" kolkhoz, an experimental complex is being developed at which protein products are being extracted from green plant mass and, by means of bioconversion of starch or cellulose, produced from feed meal or straw. The Institute of Organic Synthesis is continuing research on creating new preparations for stimulating growth of animals and plants. The Institute of Biology is studying methods for optimizing mineral nourishment of plants and is searching for new sources of biologically active substances for feed enrichment. The Botanical Garden of the Latvian SSR Academy of Sciences is planning projects directed toward increasing the assortment of crop plants for agricultural purposes.

A special commission has been created under the presidium of the Latvian SSR Academy of Sciences for the food program; it plans, coordinates, and will control this part of the program.

Ahead is very intense, purposeful work. Under the conditions of our republic, special attention should be given to feed production. Economically justified solutions must be developed with respect to the problem of protein and energy feeds and of producing them in sufficient quantity and high quality.

Plant growing is faced with providing all livestock with full-value feeds, and the technology for harvesting, storing, and processing crops should be such that, with minimum labor and energy expenditures, all feed substances get to the farm without losses. The sowing of high-protein crops must be substantially increased and, on the basis of the latest scientific achievements, the processing and storage of these feeds must be optimized. Science has shown the prospects for isolation of soluble protein parts from green mass for the needs of swine and poultry raising, and this will make significant savings in grain. It is necessary also to create technological production of high-protein food items directly from plant mass to avoid irrational losses. Fundamental research is still needed here.

However, resources of feed protein also can be increased by means of microbiological conversion of carbohydrates into a rich protein biomass. At the Institute of Microbiology, research is being conducted on the fermentation of starch- and cellulose-containing raw material. Ahead is still a large amount of work.

Meanwhile, the introduction of feed yeast production in the republic is too slow and wastes from the food, meat, poultry, and fish industries are not being utilized fully. And this is a large unused reserve.

Since we have the Livani Experimental Biochemical Plant, that is, our own production of lysine and vitamin and amino-acid premixes, it is necessary to forcefully raise the question of increasing these valuable products to a volume whereby not one ton of feed is fed in an unbalanced form.

From these examples, it is evident that there are still many problems. Therefore, in academy institutes, first priority must be given to bolder planning of original tasks having substantial influence on feed products. And, of course, success in the matter depend on how close the cooperation will be between researchers of all units and the producers. And to reduce the lengths of time in introduction of new technology, it is necessary to plug in ministerial institutes and experimental farms to the utilization of innovations in the early stages of development.

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WORK OF LITHUANIAN SCIENTISTS MORE EFFECTIVE ECONOMICALLY

Vilnius SOVETSKAYA LITVA in Russian 15 Jan 82 p 2

[Article by A. Ramanauskas, chief engineer on questions of the introduction of scientific achievements into production of the presidium of the Lithuanian SSR Academy of Sciences: "Scientists' Work Will Become More Effective"]

[Text] The 26th CPSU Congress placed large new problems before Soviet science. Today, the scientists of our country and of our republic are concerned not only with the theoretical development and practical creation of various technical innovations, but also with practice -- in industry, in agriculture, in transportation -- in short, in all sectors of the economy. Whereas during the 10th Five-Year Plan the economic effect from introducing scientific-research results into practice equalled 37 million rubles, it is now increasing by a factor of almost 3 and will reach 90 million rubles. The basis for implementing this program is improvement in the relationships between science and production.

In recent years, these relationships have been strengthened significantly. Confirmation of this is the growing attention by scientists of the republic Academy of Sciences to topics stipulated in contracts concluded with various enterprises and organizations. This year, contract work constitutes almost half of all scientific development in the republic.

Work on topics financed by cost accounting and by the budget, because of constant contact between developers and consumer-enterprises, permits substantial increase in the economic effect of developments and substantial acceleration in the introduction of inventions. Making use of the already accumulated experience of our own and of academies of sciences of other union republics, the institutes of chemistry and chemical engineering, the physics of semiconductors, and the physical-engineering problems of energy have created the first interagency units of the Academy of Sciences in Kaunas, Siauliai, Jurbarkas. Some of them, in the near future, will become the basis for creating scientific-production complexes.

As an example of such a type of cooperation, one can refer to the "SAPIS" laboratory created by the Institute of the Physics of Semiconductors at the "Nuklon" factory. Its tasks are the development and introduction of methods and hardware for mechanizing production that increase the percentage of usable integrated circuits. Preliminary data show that this work will provide significant savings in materials and raw materials, fuel and electrical energy and, already in the first years of its existence, the laboratory will have saved about 100,000 rubles for the economy.

Also, as contemporary practice shows, complexes permit the introduction of scientific achievements into production rapidly and effectively. The presidium of the Lithuanian SSR Academy of Sciences organized, on a nongovernmental basis, the first scientific-production complex in the republic -- "Elektronika." It consists of five specialized groups. The basic tasks in the work of this complex are the increase in production and the broad introduction of automatic manipulators -- industrial robots and intermediate automatic control systems with small computers. The necessity and importance of this work is discussed in the Basic Directions for the Economic and Social Development of the USSR.

The large scientific-research projects of scientists in the republic Academy of Sciences that have been introduced into production in recent years have provided a large economic effect. Thus, for example, the introduction, at four enterprises, of a technological process for glossy galvanizing with weak acid, developed by the Institute of Chemistry and Chemical Engineering, provided a first-year saving of 370,000 rubles, and a process for metal-plastic chemical bonding will permit a saving of 205,000 rubles yearly. A significant economic effect will be achieved also by a second and third generation anticorrosive galvanic covering that permits improving the quality of component coverings by a factor of 2 to 3, lengthens their service, and also reduces demand for raw materials.

A large economic effect -- 20 million rubles of saving just during the 11th Five-Year Plan -- will be provided by the embodiment in life of developments by scientists of the Institute of the Physics of Semiconductors and the Institute of Mathematics and Cybernetics of the Lithuanian SSR Academy of Sciences which will enable the automation of production on an entirely new basis through the use of semiconductors.

Research conducted by the Institute of the Physical-Engineering Problems of Energy of the Lithuanian SSR Academy of Sciences will permit an increase in the capacity of the Ignalina atomic electric power station, now under construction, without a change in its equipment. At the present time, this institute has been preparing a complex program for utilizing fuel resources in nonindustrial sectors of the economy -- in transportation, utilities, and agriculture. It will contain scientifically-substantiated measures for conserving fuel during the period up to 1985. Work on the program, the implementation of which should be completed during the 12th Five-Year Plan, is continuing and will be finished this year.

Another complex of measures, the aim of which is conservation of fuel and energy resources, is being prepared by this institute for Siauliai. It provides for the development of an optimum fuel balance for this city for the period up to 1990.

Cooperation with the Institute of the Physical-Engineering Problems of Energy is only one aspect of the broad complex program of cooperation between the people of Siauliai and the scientists of the republic. According to this program, the Institute of Physics of the Lithuanian SSR Academy of Sciences will begin to study atmospheric pollution in the city and will compile a recorder chart that will guide architects in planning new housing and industrial microregions. The Institute of

Mathematics and Cybernetics has been obligated to conduct scientific research for creating automated control systems for the city of Siauliai, and scientists from the Institute of Botany will aid in solving landscaping problems. Associates of the Institute of Chemistry and Chemical Engineering will conduct work to further improve galvanic processes and the economy of scarce nonferrous metals at city enterprises. Thus, the whole city of Siauliai and its enterprises will become a kind of testing ground, where problems in effective resource utilization will be solved and technology will be created and introduced permitting conservation of these resources and the production of higher quality products.

Much work is also being conducted by scientists of the republic Academy of Sciences with the aims of strengthening ties between science and agriculture and of wider introduction into agricultural production of the latest scientific achievements. A joint decision by the presidium of the Academy of Sciences and the Yurbarkskiy Rayon ispolkom of the Council of People's Deputies created an interagency base of the Institute of Botany of the Academy of Sciences and the "Geguzhes Pirmoyi" kolkhoz, the chief task of which is the broad introduction, under republic conditions, of promising, high-yield, and cheap forage plants and full mechanization of their cultivation.

With the aim of increasing production of nutritive and cheap feeds, the Institute of Botany has conducted a number of experiments under the present five-year plan to expand the assortment of silage plants, enlarging it with perennial crops that grow in the same place for 10 or more years and contain a large amount of protein and show little reaction to poor climatic conditions and disease. Experimental plantations of such plants have been created by the institute at the Buyvidishskiy sovkhoz-technicum and at a sovkhoz in Shal'chininskiy Rayon. With the use, as cow feed, of "Weirich Mountaineer" crops, milk yield (and the quantity of feed) increased by a factor of 1.6. This was a large contribution toward increasing the production of food products.

We have named only some of the tasks, the accomplishment of which today occupies institutes of our republic's Academy of Sciences. As a whole, the sphere of application of effort by the scientists is extremely broad. Understanding the importance of the tasks standing before the scientists, the presidium of the LiSSR Academy of Sciences, its scientific departments, and councils for coordination of scientific work henceforth will examine, as first priority, the questions most important for the economy and will put forth maximum efforts to expose new reserves for conducting the economy on a scientific basis.

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ACADEMICIAN REBANE ON ESTONIAN ACADEMY OF SCIENCES R&D

Tallinn SOVETSKAYA ESTONIYA in Russian 27 Jan 82 p 2

[Interview of K. Rebane, president of the Estonian SSR Academy of Sciences, by A. Favorskaya, a correspondent of SOVETSKAYA ESTONIYA: "Peering Into Tomorrow"]

> [Text] The president of the ESSR Academy of Sciences, K. Rebane, in a conversation with a SOVETSKAYA ESTONIYA correspondent, tells what scientists are working on today.

[Question] Karl Karlovich, recently, in a scientific article in PRAVDA it was well stated that scientific achievements powerfully compress time and we, because of intertia in thinking, often try to see into the future, failing to note that we are already living in it. Is it not really that what determines the character of technology and society in our day was laid down by fundamental science in the past . . . And today? It would be interesting to know what scientific achievements you think will have the greatest impact on practice in the near future?

[Answer] Let us note a scale of measurement. In the recent past, the truly large achievements that determine today's character of energy, engineering, and technology have been, first, atomic energy (without atomic electric stations, the energy crisis in some regions of the world would be even more serious) and, secondly, transistors, which appeared at the end of the 1940's and, over a period of 10 to 15 years, transformed the character of electronics. The very latest achievements in this area have led to the creation of semiconductor microprocessors. In these devices, as is known, miniaturization has reached fantastic limits: on a piece of silicon the size of a shirt button it is possible to lay down the calculating capability of a third generation computer. It is possible to put together hundreds of thousands of transistor equivalents and their junctions with this density. This is the material basis of the process in computer technology.

If one is talking about the not-too-distant future, there are great hopes for thermonuclear energy. It appears that by the end of the century it will begin to provide a tangible contribution to world energy.

In our day, microbiology is beginning to have an analogous impact on practice. A revolution is coming about in connection with genetic engineering or, as it is now called, technical genetics. Microorganisms are forced to work according to very precisely predetermined, strict programs: into certain bacteria, are introduced genes, that is, molecular carriers of the most precise information about the synthesis of molecules of fully defined biological substances. Meanwhile, it is a matter of producing medications -- specifically, for example, interferon for man. But the possibilities and prospects are very great. Let us make a comparison: when we order a suit from the tailor, we have to give about ten measurements. But the genetic code, which carries transplanted genes is an "order" with hundreds of thousands and millions of measurements that give the positions of the atoms in the molecules. On this basis, industrial production has already developed.

[Question] Do our Estonian scientists also work in this area?

[Answer] We occupy fully defined positions in this area. We are strong participants in appropriate all-union programs in molecular biology. Already, for a number of years, we have had a small collective of genetic engineers at the new Institute of Chemical and Biological Physics that has worked successfully in good cooperation with Tartu State University. Their joint work was recognized by a Soviet Estonia Prize in 1980.

[Question] Within the framework of the immediate tasks of our republic, which ones, in your opinion, directly concern science?

[Answer] I would say that science in the republic also receives a great number of tasks that flow directly from the practice of the country. This is also understandable -- the advanced level of engineering and technology, where the contribution of science is most urgent, develops along a united front. Some of the solutions return to the republic economy through all-union organizations -- solutions already enriched by contributions from science, technology, and management experience of other republics. But also, of course, there are areas of activity where tasks arise that are specifically for the republic. For ten years already, our academy, as is known, has had republic special-purpose programs. An example is the program for long-term planning of the economic and social development of the republic. Naturally, it receives its tasks locally in a very direct manner. Another example is the complex utilization of shales, which determines ways to utilize Estonian shales, products, and wastes from its processing that are most needed and economical at a given time or in the long term and how to solve other questions as a complex with the protection and improvement of the environment. The program "Complex Utilization of Phosphates" also is related to a problem that specifically and objectively faces the republic. Among the programs where the academy is not the head organization but takes serious part at the republic level, the food program should be mentioned.

[Question] Perhaps, something from the latter specific examples on the development of these programs . . .

[Answer] Last year, the shale program was substantially amended and strengthened. This was brought about by a wave of increased interest in shale as an energy fuel, raw material for motor fuel, and other chemical products. Contacts with the USSR Academy of Sciences were strengthened, and we had to think also about shales in other regions of the country. Our academy was visited by the president of the USSR Academy of Sciences, A. Aleksandrov, who noted, as is known, the republic's positive experience with shales in his speech at the 26th CPSU Congress.

Republic programs undergo approval by the republic Council of Ministers. Last year, three programs underwent such approval.

[Question] Perhaps you would like to say something about phosphorites . . .

[Answer] Our deposit of phosphorites resembles a puff pastry where the phosphorites are almost at the very bottom. Our specific proposal, based on the study of the problem within the framework of the program, is that we are obliged to organize underground extraction rather than pit extraction. This is reasonable because the richest phosphorite strata are located so that there has to be the equivalent of an underground method. But the difficulties of such extraction are also fully understandable: people must work underground, machines that are still not suitable in all respects, and the geological conditions for mines that are far from simple. The academy is very much engaged in this, and we are trying to act and will act together with ministries and other organizations. Sometimes they are with us, and sometimes they are against us; it can't be helped: they have their own specific tasks and their own indicators and capabilities. But the academies of sciences must stand for wider understanding of the country's interests: for solutions which, though more difficult today, are substantially more advantageous in reasonable perspective.

[Question] What do the programs provide in the way of research organization?

[Answer] When, five years ago, the first results were summed up, it already was felt that this was an up-to-date form of coordination for scientific research. Today, I would even say that it is difficult to name any truly worthwhile scientific results -- both for practice and for themselves -- that have been achieved in recent years outside programs. And with this five-year plan, special-purpose programs have been placed at an even higher level on a country-wide scale.

Within the framework of the program "Preparational Biochemistry," we are planning for a microbiological industry here. In this five-year plan, production has begun and will be developed in our own Academy of Sciences, because there is no place else. But subsequently, we will go outside the academy. We are now, in fact, producing in the laboratory pure biological preparations that are even going into the international market. The quantities are insignificant, and the prices are very high (parts of a gram and hundreds of thousands of rubles), and the equipment and production environment are such that it is still not possible to create two parallel units. It was once like this with atomic energy: there, a very sophisticated environment was necessary and, at the beginning, it also was developed within the USSR Academy of Sciences itself as there was no place else to do it. And it was the same with semiconductors, for the production of which a whole new level of understanding had to mature.

[Question] Are there examples where a project fulfilled in the academy looked good but, when it went into practice, it was not utilized?

[Answer] Among the large proposals, very unfortunately, during the last five-year plan, the production of fragrant substances at the Maardu Chemical Plant was not successfully realized. Apparently, the significance of the products for the country was not sufficiently great to be able to compete for capital investment funds. Now, there is talk of introducing, not fragrant substances, but a new generation of products based on the same chemical compounds -- preparations for agricultural chemistry. Incidentally, I am optimistic about this, because now much less capital investment is needed and the product is much more timely -- it is actually a direct contribution to the country's food program.

[Question] Is there, perhaps, also the problem in introducing new technology that in industry it is necessary to have people who understand the language of modern science?

[Answer] I think that this is one of the factors in introducing new technology, but it is not decisive. The main thing, nevertheless, is that the economic mechanism that gives the green light to all reasonable introduction has not been worked out as it should be. I think that this is the responsibility of our economists.

[Question] But they propose much and advise what is reasonable. They have said this themselves many times.

[Answer] Yes, but I think that the final results are what is significant. Of course, a large number of problems crisscross; the problem is difficult; but, nevertheless, this is where the greatest weakness is -- in economic, and also personal incentives, both at the enterprise and ministerial level and, simply, at the level of the people who work at it. The business is still not set up to be most advantageous to work for producing a final result that is useful both for the economy and for all of us.

[Question] In this five-year plan, the chief task is intensification. How is this felt within science itself?

[Answer] It is necessary to produce final results that are more effective in our business, too. As for the number of scientific collectives, growth is almost absent already. It is a matter of certain reduction in staffs. At the same time, the wage fund per worker, I hope, will grow. The training of personnel is definitely important -- the further strengthening of relations with republic VUZ's and broadening and deepening the training of our scientists -- and not only young ones -- at all-union scientific centers. The weakest point in raising the effectiveness both in fundamental and applied research is scientific equipment. Although, in theoretical work, Soviet scientists traditionally are at an advanced world level, in experimental work, unfortunately, we do not always move as fast as we would like; we react with difficulty to new methods and new trends, and we lose out in productivity of scientific and auxiliary personnel precisely because of the lack of equipment. In the USSR Academy of Sciences, large amounts of effort are being put into the development of equipment, and there are definite results. In our academy also, one of the programs is "Scientific Instrument Making."

But the most important thing for intensification is to plan science correctly: to define the goals clearly and drive the tasks home to every associate so that he knows precisely what he will be doing tomorrow, in a week, and in the long term; what he is responsible for; and what hi personal capabilities for growth are. In my view, the improvement of science management on the part of leading scientists, to more thought-out and specific planning, is one of the internal reserves of our academy.

[Question] And what is intended during this five-year plan in cooperation with other scientific centers of the country?

[Answer] If you had asked what is intended other than contacts, I would not know what to answer. Even such a traditional "nationality" field as the study of Estonian language and literature is part of general research on Finno-Ugric languages. We design and build laser spectrometers, for example, both for ourselves and for institutes of the USSR Academy of Sciences. We do this in close contact with about ten collectives in various centers of the country, and there are many more other types of contacts. And, again, in programs, even in republic programs, there is participation by specialists from many organizations outside the academy and outside the republic. Our task is to work unfailingly to take into account the best that is being done in the world. We will not stop progressing.

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PRESENT-DAY PROBLEMS IN ESTONIAN GEOLOGICAL SCIENCES

Tallinn RAHVA HÄÄL in Estonian 16 Dec 81 p 2

[Article by Dimitri Kaljo, director of the Institute of Geology, ESSR Academy of Sciences: "Effectively, Comprehensively...Present Problems of Geological Science in ESSR"]

[Text] The 26th CPSU Congress evoked active discussion and a search for new directions in all aspects of life. Effectiveness, concentration, and comprehensiveness became new slogans for directives, with relevance and fundamentality added in scientific fields. The principles expressed at the congress led also to a careful analysis of the work of the Institute of Geology of the ESSR Academy of Sciences, and the open party meeting held in spring noted with satisfaction that our science policy of recent years has been in harmony with demands made of science in the modern world. But this does not mean that nothing can be approved. On the contrary, the fact that the national economy of the republic and of our entire country is departing on an intensive development bath, that there is the food program and progress in basic research as well, bring out ever new problems and practical tasks.

Geology as a science has its own specifics, ignorance of which makes difficult correct adjudgment of research and its results. The undersigned holds that two facts are of primary importance here--first geology as a branch of national economy and geology as science are closely related (applied geology includes many elements of scientific work and vice versa), and second the close relationship between regionality and fundamentality (very often basically new results of geology have evolved from regional research).

We have used the above-mentioned relationships as a model for outlining our program, in directing and concentrating it. It is easily seen that the interests of the republic's economic and cultural development influence us through two channels, through the geological service as well as through regional problems and needs. This is the reason why topics associated with the republic play a great part in the Institute of Geology, and also influence the relative breadth of the institute's work. We hold that the Institute of Geology must be able to participate in all problems arising from the actuality of the republic and connected with geology.

As far as basic research is concerned, we are primarily attempting to develop in directions that are based on research of the base and surface of the ESSR. Paleontological, stratigraphical, lithological, quaternary and istope-geological work has its roots here, but has acquired a wider meaning thanks to the level achieved. We have applied methods developed by the institute directly for research in other areas (such as the Siberian plateaus, Spitzbergen, Arctic areas of the USSR and elsewhere) but this direction cannot be considered the main path. At the same time it goes without saying that the aim of each scientist must consider the All-Union and international level of research, rather than its extent.

Let us take a closer look at some of the problems of the geological practice in the republic. It is known that the state geological service--the ESSR Geology Administration--has concluded a comprehensive, mid-scale mapping of the republic, which included the collection of very extensive data and mapping materials, and which will assist in the successful solution of many problems of the national economy. However, there is a continuing need for detailed data and for this reason large-scale mapping is already underway. One must stress that this should not merely be a more accurate and more extensive work, but must also provide answers to many questions regarding the geological structure, development, and resource location of our republic. Included are also strata segmentations, profiling and rock formation.

A contribution for meeting these tasks is of primary concern to the stratigraphers, lithologs and paleontologs of the Institute of Geology. Associated topics have constantly been part of the institute's plans, organs for collaboration with the practical workers have been established, etc. Apparently, however, the institute's contribution could be more effective and better organized, especially if beside so-called socialist requests we would be better informed of the concrete needs of the Geology Administration. Research into the main natural resources of the ESSR--oil shale and phosphate--has been well coordinated with the relevant republican programs in view of preparations for comprehensive utilization. Managers of these programs (ESSR Academy of Sciences corresponding members A. Aarna and M. Veiderma, respectively) have performed a great and grateful job in coordinating research and experimental work. The Institute of Geology participates in both programs, but with relatively few people, clearly inadequate in the case of phosphate research. However, meaningful results have been obtained even here. For example, H. Heinsalu, chief of the phosphate research team of the institute prepared a candidate dissertation this year that drew some interesting conclusions about the composition and origin of phosphate rocks. The discovered processes are useful in further detailed research of the phosphate deposits of northern Estonia.

Considering the possible extent of the above-mentioned deposits and the farmers' ever-increasing need for phosphate fertilizer it is clear that we must make serious efforts to strengthen that research team with personnel and material resources. Besides internal reserves we must call for assistance from outside.

Quite recently the burning of oil shale appeared to be the only economically justifiable use, but the extraodrinarily rapid rise in oil prices on world markets has cast new doubts about the sole use policy. Thus it is logical that once again basic questions regarding the nature of oil shale materials, its occurrence, nature and origin of deposits, etc. have once again become acute. Since the oil shale of ESSR and the Leningrad oblast are the most-analyzed in the USSR and since there are certain experiments that have been made, our assistance is expected in analyzing other oil shale deposits in the USSR. Although this proposal is in conformance with the model of our science policy it is not easily realized. Once necessary means are obtained a start should be made in educating personnel and considerably strengthening the laboratory basis. It would be helpful if the Tartu State University would also consider the perspectives of oil shale research in training young specialists.

And not merely in training the young. At the recent meeting of the republic's geology committee the charter and work plan of a new research laboratory to be established in the geology department of Tartu State University were under discussion. This unit, growing out of the current minerology department of the Geology Administration is to make an essential contribution to investigating natural resources with physical methods. The results of the laboratory chief, K. Utsal, have been promising to date, and we deem it essential that the work program of the laboratory will also include cooperation with institutes of other collectives, and not merely with a view toward expanding oil shale-related research.

It is known that mining of natural resource is accompanied by various changes in surrounding nature, or, as it is often said now, in the geological environment. Restoration of so-called moonscapes resulting from open pit mining has been successful thanks to the results of research conducted by the Estonian branch of the Mining Institute imeni A. Skotchin, but completely new problems arise in extensive mining areas in connection with the collapse of the roofs of mine tunnels after conclusion of mining. Depending on the geological conditions lowering of the surface by a couple or a few meters can result in waterlogging of fields, destruction of drainage systems, changes in the ground water system, etc. Without relevant research prognosis is almost impossible, but need for it is increasing daily, since the new oil shale and phosphorite deposits are located under the best Pandivere fields. The restoration expenses for open pit mines have been included in the mining costs, the same should be done in eliminating the results of subterranean mining, since experiences indicate that this is the most effective way.

Both the above-mentioned Institute for Mining and the Institute of Geology have begun to prepare necessary data and prognosis, participating also in the corresponding all-Union program. Specialists of three sectors of the Institute of Geology (geology of natural resources, quaternary geology, and hydrogeology) are participating in this undertaking, but it still cannot be said that research is vouchsafed for all necessary problems. A lack of researchers is felt (this is to some degree alleviated by internal concentration of personnel) and a certain departmentalization--after all, the

Institute of Mining deals primarily with oil shale. At the same time the areas of North-East Estonia require special attention, since there oil shale layers are located on top of deep-seated phosphorite deposits. A comprehensive approach that takes into account mutual interests and the region as a whole is needed, as well as an integration of the oil shale and phosphorite programs and their supplementation. To date there has been little work done in this field, but in the interest of North-East Estonia's optimum development the question needs an answer soon at the appropriate level.

The above short survey regarding geological problems associated with the republic's national economy showed that they are numerous, multifaceted, and serious. In several instances we were able to note a gratifying progress, but at the same time shortages of personnel and material resources had to be noted. In such a situation the cooperation between the various sectors of the institute has been quite fruitful. Lack of personnel does not always allow for establishment of a dedicated group for researching a ceratin problem, but specialists from related fields can be called upon to solve the problem, without the need for them to leave their basic assignment. In this way data and experiences made in the couse of related work can be applied, as can the material resources of various sectors. In view of this positive experience we prefer an Institute of Geology with a relatively broad profile to geological subsectors in various institutes (agriculture, the various natural resources, etc.). In this way the scientific potential is being better used.

In conclusion one should stress the positive influence of a planned direction and management of science both on the development of science itself as well as on the increase of efficiency of the practical applications in the national economy.

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ESTONIAN CHEMISTRY INSTITUTE R&D COORDINATED WITH PRODUCTION

Tallinn RAHVA HÄÄL in Estonian 21 Jan 82 p 3

[Article by Kaarli Urov, deputy director for scientific matters of the ESSR Academy of Sciences Institute of Chemistry: Basic Directions of Research in the Chemistry Institute"]

[Text] /In boldface/ The ESSR Academy of Sciences Institute of Chemistry, decorated with the Order of the Red Banner of Labor, is the main organizer and coordinator of chemical research conducted in our republic. This task is facilitated by the experimental plant for organic synthesis and bioproducts founded in 1979, as well as the inclusion of the institutes in the first category of scientific organizations. Let us then take a look at the plans made for 1981-1985 and at problems that are rising in this connection.

Our institute has been assigned three basic directions of research: 1) organic synthesis, physical-organic chemistry, and preparative biosynthesis; 2) physical-chemical research methods and construction of scientific machinery; 3) chemistry of earth resources and the scientific foundations for their rational use. /end boldface/

In the field of organic and bio-organic synthesis research will focus on possibilities for developing new plant sprays and other biologically active compounds, on developing compounds with active surfaces, and perfumes. Professor Koit Laats, and the sector of organic synthesis headed by him has for years conducted research into telomerization reactions, and have developed a new mechanism for these reactions. It was also determined that isoprene, an obtainable and relatively cheap hydrocarbon, can through these reactions yield several products useful to the national economy. Some of the telomerisation products of isoprene consist of new smelling substances needed not only by the perfume industry but also by applied chemistry--and in much larger quantities--to improve the character of detergents and other products. The institute's experimental plant produced 2.5 tons of synthetic iris oil in the last five year period, and this led to a partial cancellation of the imports of this product. Now the attention of the synthesizers is ever more focused on biologically active compounds formed in the same reaction chain, with analogs and pheromones of steroids being of the greatest interest, since they are effective pest control substances, and practically without any harmful effects on humans. While the well-known poisons (organic compounds of chlorine and phosphorus) have to be spread in quantities of some 50 kilograms per hectare to be effective (and while these compounds are also quite poisonous to humans) only 200-500 grams of steroids are necessary for pest control in the same area, and 10-20 grams of pheromones. Plans call for plant hormone production in the institute's experimental plant in this five year period to control the greenhouse beetle in the republic's greenhouses, with the expected economic benefits amounting to a million rubles a year. However, the experimental plant cannot produce large quantities of olfactory compounds and plant poisons; the main task of experimental production is the preparing of new products and their production for inclusion in the output of large industrial enterprises, not the exclusion of the latter. The institute has prepared a data base for a comprehensive experimental production of plant poisons and olfactory products, at first in the Maardu Chemical factory, where plant poisons in amounts sufficient for pest control on a million hectares of agricultural lands are to be produced.

In 1976 research was begun under the direction of Doctor of Chemistry Ülo Lille in the synthesis of prostaglandins, active bioregulators. In the last five year period methods for biochemical synthesis of two prostaglandins were developed. E_2 prostaglandin was produced in the institute's experimental station in quantities that for the first time permitted a broad clinical testing of the product in the USRR, the F_2 prostaglandin has been successfully used in animal husbandry, and other compounds of this class have also been handed over for field testing.

In the field of surfactants synthesis of new compounds is continuing, especially of those containing nitrogen and being polyfunctional. The effectiveness of produced compounds is tested, the products with the best characteristics are introduced into the national economy.

The "Orto" combine has begun to introduce a foam detergent developed in the Institute of Chemistry, the tests with surfactants designed for the photographic industry are running smoothly in the respective all-Union organizations. The compounds developed in the institute permit a considerable reduction in the grain size of photo-sensitive materials, and improve the sharpness of the image.

Remarkable progress has been made in the work done under the direction of ESSR Academy of Sciences corresponding member Olaf Eisen in the field of physical-organic chemistry and research methods of physical-organic chemistry. Plans call for the introduction of the most powerful analytical tools--chromatomass-spectrometrics--in this five year period, and for a expansion of laser chemistry. Original tools have been constructed in the institute (rotating rectification columns, ebulliometers, etc.). The new methods and implements are used to produce etalon materials of extremely great purity.

The institute's third scientific direction, a tradiational one--concerning chemistry of earth resources, primarily of oil shale--is directed by

Professor Ilmar Klesment. The Institute of Chemistry is currently virtually the only one in the USSR where systematic basic research into oil shale is carried out, and it has become a methodological center for this field. Data received from 1976-1980 about the composition of oil shale from more than 30 localities led to a generalized scheme of the genesis of this resource, and work is underway for a scientifically justified classification of oil shales. This work will be concluded in this five year period. Parallel with establishing criteria for determining the use of various oil shales a method was presented to considerably increase oil production in the distillation of oil shales poor in organic matters. In the period facing us special attention will be paid to research into the composition and characteristics of dichtyonema layers, so as to develop measures for utilizing this currently unused byproduct of phosphorus production. Work will begin on more thorough research into the heavier fractions of oil shale oil. The above should indicate that the work of the Institute of Chemistry is directed at finding solutions to problems that are important for both science and practical application. For this five-year period there are a number of good intentions, some of them being already realized. However, several problems arise from an analysis of the development of the institute. For example, there is the need to coordinate and realize to the optimum the concentration and mobility of research topics on the one hand and the rational application of the scientific personnel and a continuum of scientific work on the other. Chemistry has become an extensive complex of various branches, so that a certain specialization is necessary for achieving meaningful results. Thus there is a need for concentrating topics, and to focus resources on the most important directions. At the same time themes have to be adaptable, nonproductive topics must be concluded in a timely fashion. Yet, it seems that a reduction of topics over the years (concentration) and the importance of new topics in research plans (mobility) cannot be the sole criteria dictating the work of a research institution. Scientific work is characterized by continuity, the necessary knowledge and experience is gathered over years and any approach to a completely new project requires some degree of getting used to. And although the importance of instrumentation is constantly increasing in contemporary research, science is still primarily conducted by the brain. Each research topic is headed by a leading scientist who has devoted years, sometimes his entire life to that question, and for this reason a sudden or frequent change to new topics can and often does have a negative effect on the results of the project. As shown above, research topics for the Institute of Chemistry has historically developed along rather broad lines, and its concentration and renewal will continue to be problems that cannot be solved overnight.

A second problem concerns the proportion of basic and applied research. An academic research institution is primarily tasked with developing the first area, even though a considerable part of the institute's work concerns application as well. Every scientific project should after all have a practically useful result for the national economy, the question is whether a specifically applied use is expected to be immediate or whether there is a possibility for treating the problem in depth over a longer period of time. An optimal solution lies in a broad cooperation with industrial branch institutes on the principle--the academic institute raises the idea and treats the problem initially, in broad strokes, while the industrial institution is responsible for applying the idea in the national economy. For this reason the Institute of Chemistry has constantly expanded its cooperation with industrial branch institutes, and plans call for an even more extensive cooperation and specialization during the current five year period. A positive example is cooperation with the USSR Ministry of Chemical Industry begun in 1977 that permits for coordination and application of results on a necessarily high level.

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MEASURING VALUE OF RESEARCH

Tallinn NOORTE HÄÄL in Estonian 8 Dec 81 p 2

[Article by Harry Oiglane, candidate of physical and mathematical sciences: "How To Measure the Value of Research?"]

[Text] It is often written and said that science has become an immediately productive force in the scientific and technical revolution of today. There is considerably less talk about problems that this has caused science. Science and production join into a productive complex in which all that is essentially new derives from the fact that the results of science have in addition to an intuitive value also a practical value. The functions of science in society have been succinctly and concisely described by philospher Jaan Rebane ("Methodology of Science," 1979): "Sciences shows, first, what exists in the world (in nature and society), what connections and causalities here (a scientific world view in the forefront of constantly developing basic sciences); second, what man can basically do to influence processes of nature and society on the basis of what is known; third, what possibilities for influencing natural and social phenomena it is meet and right to use, and how they can be used specifically."

Science has always had such spects, but since the role of science used to be more modest in the society, there was not a great need to investigate them seriously. Now things are different. For example, a considerable part of national income in the USSR is expended for scientific development, the number of scientific personnel together with the scientific and teaching staffs of institutes of higher education is approaching 1.5 million. More than 4 percent of workers and employees are working in scientific fields. It estimated that about three quarters of increases in labor productivity is due to increases in the technical level, i.e. due to science. For this reason science has become an object for research, including research by economists.

Scientific work is usually divided into the following stages:

a) Theoretical and experimental research designed to gather new information from nature and society. This is so-called basic research.

b) Applied research into results of basic research.

c) Planning and construction work.

d) Construction of experimental models of new implements and machines, and of new methods of production.

From then on the results of science are transfered into the sphere of production, finding their application as new work methods, new technology, new products, and also as an increase in productivity.

It is estimated that the applied value of scientific information is constantly increasing by moving along the steps outlined above. This opinion is based on the fact that at each stage additional material resources and labor are used and additional information is being applied. There are, however, other opinions, namely that the applied value of science is in existence at the very beginning, in the results of basic research. The entire subsequent process is necessary only for bringing out that applied value.

When looking at science as an object for economic research, several other aspects must be borne in mind. The cycle of research lasts for a long period before the results are expressed in the productive sphere. In the meantime the national economy has progressed, prices and many other indicators have changed. Expenditures for science and the derived economic effect can no longer be simply compared, even if they could be determined exactly.

Risk is a part of scientific work by its very nature. A concrete work of scientific research can be without results. It is estimated that 30 to 50 percent of expenditures for science are devoted to financing such projects that in their final analysis contribute nothing. In applied research and projections this percentage is lower--10 to 15. What are the reasonable limits for unsuccessful research in research institutes? Nobody can answer that. And sometimes there is not even an answer to the problem whether the result of the research is without value of whether a key for future technology is hidden in it. For example, there was a time when nuclear research in the USSR was considered a waste of national resources.

The problem as to what extent science should be financed at all is also of great importance.

Academician V. Trapeznikov estimated some time ago, that each ruble devoted to science results in an annual increase in the national income of 1.45 rubles. Each ruble devoted to usual capital investments results in an annual increase of national income of 39 kopeks. Consequently, financing of science is 3.5 times more effective than usual capital investment. The economic character of work in basic science is a complicated problem. Large collectives and expensive material resources are devoted to research. It is estimated that by the end of this century 20 percent of the labor force will be directly or indirectly dealing with scientific work. The major part of scientific research has a direct economic effect--in the sense that it furthers the development of productive forces. Once the results of fundamental research have gone through the stages and reached production, basic researchers have also made their contribution to increasing national wealth. Once scientific research become an organic part of technological processes, then science has become an integral part in the production cycle. The work of the scientist must be considered socially productive work. The results of his work have an applied value.

Actually, all of this is not as simple as it might seem at first glance. The result of a scientist's work, new information, is not lost through use. In such cases does it make much sense to speak of the value of such results? Is there any sense to talk about the amount of water in a well that has no bottom? The applied value should be measurable. But how great is the applied value of a differential equation or of the laws of thermodynamics? Equally complex are the questions regarding the cost of research. Since scientific work by its nature is a one-time or unique event we cannot determine the average amount of time expended for obtaining the results. We cannot objectively measure whether the collective that arrived at the results worked efficiently or whether it was lazy. From this the multifaceted and contradictory problems of measuring the effectiveness of scientific research arise.

Much expensive machinery and installations is in use by science. But it is not clear according to what laws the value of that machinery becomes a value of the new scientific information. The depreciation of machinery used in science can of course be calculated according to some prescribed rules, but the value of the machinery cannot be transfered to the results of new scientific work. Further, there is no depreciation at all of the scientific information, new results of science. The laws of thermodynamics have been applied for thousands of years, without their economic or informative value declining. On the other hand, the laws of thermodynamics would be useless to man without people who are aware of these laws and know how to use them. Therefore, expenses for science must also include the expenditures necessary for keeping the results of scientific work alive. These include expenses for training specialists and for vehicles used to preserve scientific information (publishing the results of scientific work, preserving it in computer memory, etc.). Taken together, these considerations represent a complicated tangle which practically makes a determination of the cost of scientific work impossible.

A paradox has thus arisen--science has become a productive force (in fact it has always been one) but it cannot be manipulated with the traditional methods of economics. This is reflected also in the management of scientific institutions and science in general--there is a lack of several objective criteria, intuition derived from the experiences of leading scientists become- determining. The number of highly qualified and widely experienced specialists is infinitely higher in science than in other branches of the national economy. Subjective criteria are quite important both in evaluating results of scientific research and for making prognoses. This means, that questions of a scientist's ethics also play a great part. It is, after all possible, that a good specialists with a low ethical level will objectively harm science with administrative methods. Unfortunately, the ethical problems of science have also been little researched.

Such a complicated phenomenon is science in the system of national economy. Only now we are beginning to understand all of the problems associated with this, to pose these problems clearly. But it is well-known that the correct formulation of the problem goes half way toward its solution. This is probably true also for science economics. There is no doubt that questions associated with science represent a new developmental stimulus for Marxist economics.

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CALCULATING FINAL RESULTS FROM NEW TECHNOLOGY

Yerevan PROMYSHLENNOST' ARMENII in Russian No 12, Dec 81 pp 22-25

[Article by A. A. Zhdanova and R. T. Arutyunyan, engineers: "With Consideration for the End Results (Concerning Qualitative Indicators of Scientific Research and New Technology) -- A Discussion"]

[Text] The "Basic Directions for the Economic and Social Development of the USSR for 1981 to 1985 and for the Period up to 1990" orients the country's economy toward the achievement of lofty end results. This pertains equally to scientific-technical and production activities that are integral parts of the "research - production" cycle. Detailed analysis of the cycle[1] shows that the end result of scientific-technical activity and the production activity based on it are one and the same -- production and the introduction of new technology.

Meanwhile, as a rule the exploitation of new technology in related sectors should be considered an end result. Questions on the exploitation of new technology and assessments of its quality in various economic sectors have their own characteristics. Let us look at them, using as an example the sectors that serve construction.

From the vantage point of end results, the production of construction materials, the manufacture of pieces, components, and structures from them, and the erection of buildings and facilities from the latter can be looked upon as individual stages of production activity by industrial enterprises directed toward the creation of apartment complexes, industrial centers, and so forth. These stages are still not united organizationally. However, this process has already begun: the creation of housing, factory, and rural construction combines, which provide for organizational unity in fulfilling construction and maintenance work and factory preparation of components and structures, and the planning of construction production according to overall result -- an indicator of the output of construction items.

Up to the present time, the scientific-technical activities of scientific-research and other organizations in the construction-materials, construction-industry, and construction sectors, industries have been looked upon in isolation within the confines of each sector. However, if new technology produced in one sector, in machine building, for example, finds application in another, the end result of scientific-technical activity for all of these sectors is also the same thing -- the creation of housing complexes, industrial centers, and so forth. Therefore, scientific-technical activities in the construction-materials industry and the construction industry, construction, and architecture, from the point of view of achieving end results can also be presented as a unified process, subdivided into individual stages.

In this way, the sectors being examined are essentially links in the unified structure "construction materials - construction industry -- construction," producing one end product on the basis of the intercoordination of production and scientific-technical activities, both in each link (that is, at the corresponding stage of activity) and in the unified structure as a whole. In this connection, the total result of the activities in each individual link is represented as an exponent of the end product. It depends on the scientific-technical activities of a different character, from which projects must be allotted for the creation of machines and equipment. A special feature of these projects is that qualitative indicators of production looked upon as new technology prove to be outside the framework of the unified structure "construction materials - construction industry - construction," since they pertain to other sectors of industry that are not a part of this structure. In the unified structure are found reflected only the quality that is manifested in the sphere of the exploitation of new construction machines and equipment.

At the same time, the overall result of the activities within each link can be characterized in two ways: directly within this link, and also within succeeding links. Such an approach, with consideration for the end results, permits objective evaluation not only of the level of scientific-research work but also of new technology being introduced into production.

Insofar as the end result of scientific research is the introduction of new technology, there are no special differences between the criteria for evaluating either the scientific-technical level of scientific research or new technology. Both are evaluated by means of the same indicators (world, interministerial, ministerial, and local levels) through their comparison against standards. A standard may be abstract (hypothetical or modeled) or a concrete prototype. At the same time, in evaluating the quality of scientific research and new technology, standards are applied that are different in principle according to their content. A standard in the evaluation of scientific research is a posed scientific-technical problem (a task), and in the evaluation of new technology, the satisfaction of a specific social need.

Consequently, in the evaluation of quality, it is necessary to take into consideration indicators that characterize scientific research and new technology in all stages of scientific and production activity. For example, the quality of light filler should be considered not only in light concrete (that is, in the industrial construction materials sector) or light-concrete structures (that is in construction industry), but also in buildings and facilities (that is, in construction). Thus the application of a light filler can, as a final result, change the volume of a building structure. If using new technology leads to changes in the number of storeys or outer dimensions of a structure, the qualitative indicators of new technology should be looked upon as a resulting stage under conditions of complex construction.

On the basis of what is presented above, we come to the conclusion that, in the evaluation of scientific research and new technology, it is necessary to use a large quantity of indicators. Therefore, there is a need for their systematization which, in our view, should be done on the basis of necessity and sufficiency. The necessary quantity of indicators is that which allows distinguishing one manufactured item from another. The requirement of necessity can be verified according to criteria of the substance of the indicators (properties). The requirement of sufficiency is considered to determine the effect of indicators on the overall level of quality of new technology, that is, it is verified according to criteria of effect.

The whole list of qualitative indicators must be subdivided into three basic groups: the economic group, which characterizes the degree of satisfaction of specific requirements for products in accord with their porpose; the technical group, which determines the possibility for using the products according to their purpose; and others, which include sociological, social, legal, and so forth.

These groups of indicators should be applied at all stages of scientific-technical and production activities to preserve the unified approach to the evaluation of qualitative level. But depending on the final result of the activity and the aims in evaluating new technology, not all groups can be considered and, within each group, not the whole list of indicators.

Indicators of all the designated groups can also be systematized according to seven classification indications (see diagram [not reproduced]). For example, according to modes of characteristics, they can be subdivided into direct and indirect. Direct indicators directly reflect the level of quality and indirect indicators, only with the aid of other values functionally related to changes in quality.

In accord with the general principle for constructing scientific classifications and on the basis of the criteria introduced above for evaluating quality for each type of scientific research and new technology, a hierarchical system (tree) of indicators should be created, where a transition is accomplished from the integrated and generalized to the grouped and then to the single indicators (according to the quantity of properties being considered). For example, a hierarchical tree system of economic indicators for stone quarrying and stone cutting equipment can be constructed in the following manner. At its zero level is the generalized indicator -- total economic expenditures for producing a certain amount of useful effect; at the first level are total economic expenditures for the creation, production, distribution, and exploitation of products in volumes consistent with society's needs; at the second level are total expenditures of social labor for the creation, production, distribution, and exploitation of units of finished production. At the following levels are such indicators as the following: calculated wholesale price, normative for profitability, cost of capital repairs, wage expenditures, electric power, and so forth.

The hierarchical tree for technical indicators looks like the following. At the zero level is found the generalized indicator of the entire useful effect received by the economy with the exploitation of products in a volume consistent with society's needs during the optimum period of functioning; at the first level is the total useful effect from exploitation of products in the volume of their actual manufacture during the actual period of functioning; at the second level is the total useful effect from exploiting a unit of the product during its length of service. At the following levels are such indicators as: yearly operational and hourly technical productivity of a manufactured item, effective time fund, established replacement rate, and so forth.

The above mentioned indicators of the qualitative level of new technology in the unified structure being examined according to the cited classification have still not found widespread application, particularly in our republic. One of the reasons is that the scientific-technical activities of scientific-research organizations of the republic (the Scientific-Research Institute of Stone and Silicate of the ArSSR Ministry of Construction Materials, the Armenian Scientific-Research Institute of Construction and Architecture of ArSSR Gosstroy, and others) are primarily looked upon in isolation within the framework of their own sector. For example, let us suppose that a new stone-quarrying machine has been created which, according to design and technological solution and quality of manufactured units corresponds to the best world levels. However, the building blocks produced by this machine are no longer used because their measurements do not correspond to construction needs. If this machine is looked at from the vantage point of construction, and not from that of the construction-materials industry as it was earlier, its qualitative level not only sharply declines, but the machine itself may prove useless. It is true, within the confines of one scientific-research organization, that the quality of new technology is looked upon from the vantage point of its exploitation. Thus, in the Scientific Research Institute for Stone and Silicate, problems related to the creation of new stone-quarrying and stone-cutting equipment, and also the development of technology for the production of expanded pearlite and manufactured items made from it are solved with consideration for producing a useful effect in the sphere of exploitation. At the Armenian Scientific-Research Institute for Construction and Architecture, the technology for light concrete is developed on the basis of the real conditions of application in appropriate designs, and of the designs in buildings and facilities of certain types; at PEKTI [expansion not available] of the ArSSR Ministry of Industrial Construction, development of structural systems and space-engineering decisions for multistoreyed apartment buildings is conducted with consideration for their construction in complexes. However, among individual scientific-research organizations, particularly with different agency subordination, the necessary relationships are absent.

As a result, the problem of developing structurally light concretes of lower weight/volume has not been solved; the introduction of pearlite concrete has been delayed to the extent that pearlite ballast and rolled porous fillers are lacking -- since a number of technical problems in their production have not been worked out; equipment designed for nonmetalliferous materials is being used to produce natural porous fillers.

These and other similar problems often are not solved because there is still insufficient coordination among scientific-activities at various stages. Their solution in large part can be aided by republic Gosstroy, which has responsibility for scientific-technical activities in the sectors being examined. In this connection, it is necessary that questions relating to the quality of scientific research and new technology be looked at from the vantage point of achieving end results according to all the basic groups of indicators.

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